The Welding Engineer

Reg. U. S. Pat. Office

Founded by L. B. Mackenzie, 1916

WITH WHICH IS COMBINED ACETYLENE JOURNAL

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JANUARY, 1931 | VOL. 16. NO. 1

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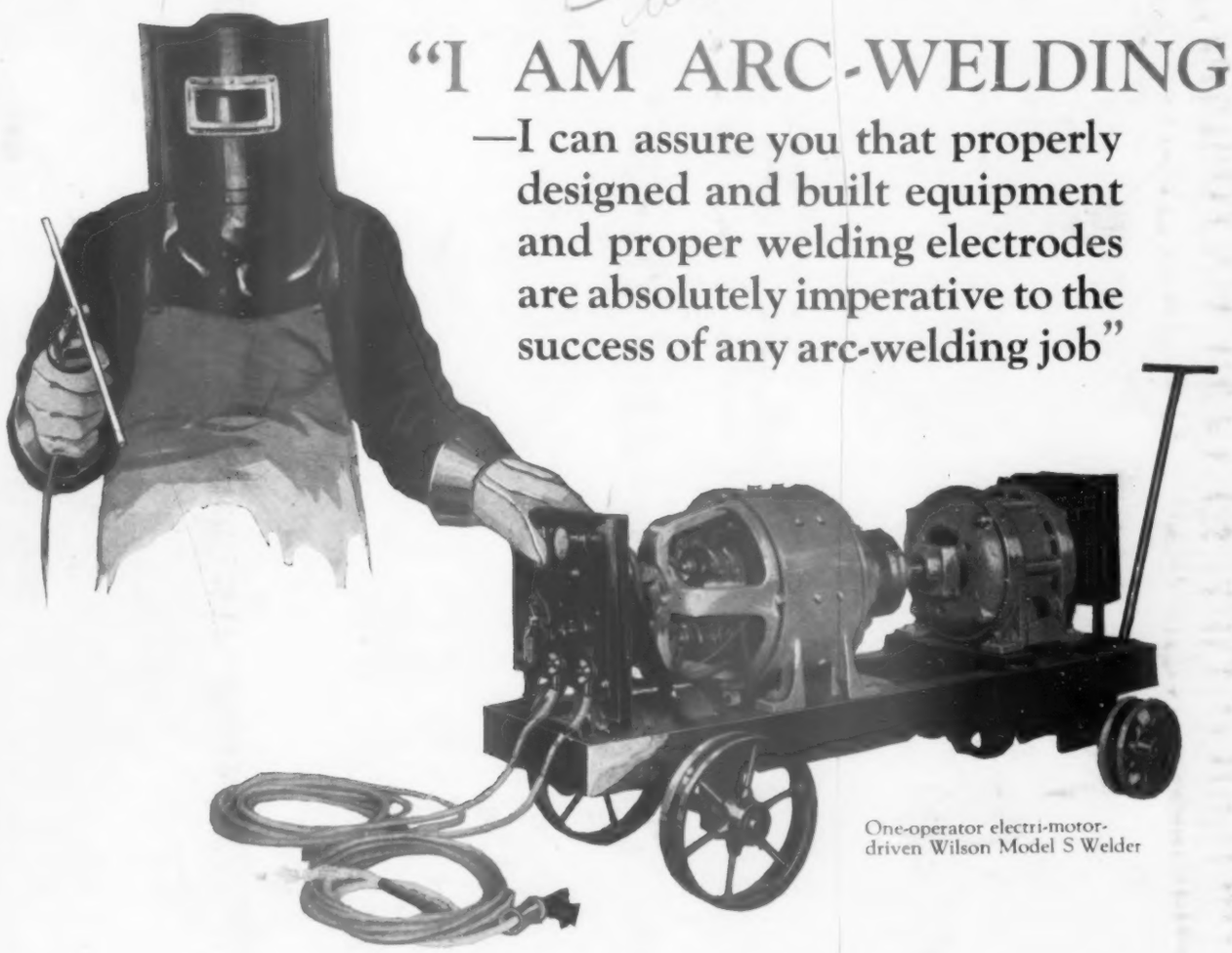

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The Welding Engineer

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A Greater Service

EFFECTIVE with the January 1931 issue, *Acetylene Journal* is merged with *The Welding Engineer*. For over thirty years *Acetylene Journal* has been the exclusive trade journal of the oxy-acetylene industry, and for fifteen years *The Welding Engineer* has been the leading business paper in the general welding field. The merger of these two publications offers opportunities for greater and better service to our readers in the future. The combined editorial staffs bring to the new order of service a background of many years of intimate contact with the welding industry and its problems, a broad knowledge of the needs of the reader, and skill in serving those needs. New activities, made necessary by the enormous growth of this industry, can be undertaken by the merged papers as the result of eliminating duplication of effort.

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As for our advertisers, the greater coverage obtained through this merger is an advantage which is so obvious as to require little comment. Since both papers are A. B. C. members, a complete, certified analysis of all the facts pertaining to circulation is accessible to all. A greater return in value for the advertising dollar will be the logical result.

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Last Advertising forms close at 8:00 a. m. on the 12th. To show proof for correction copy must be received at an earlier date and allowances should be made for delay to mails. All copy should be in by the 12th of the month at the latest.

The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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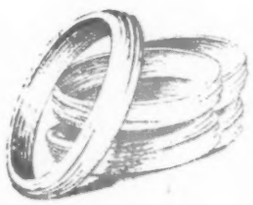

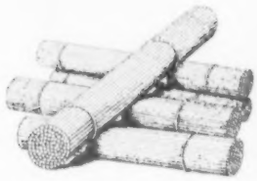

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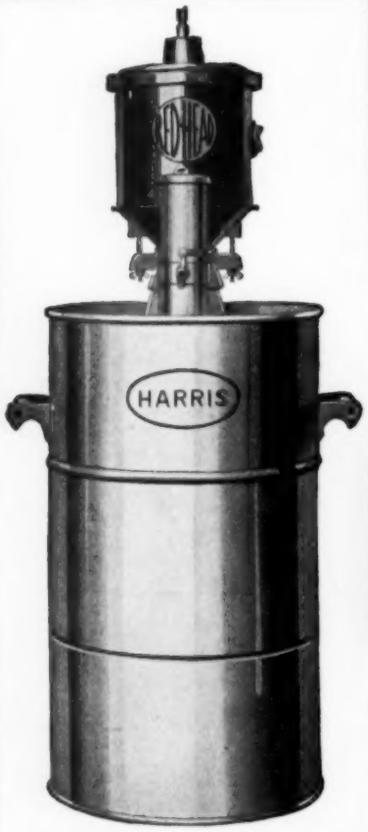

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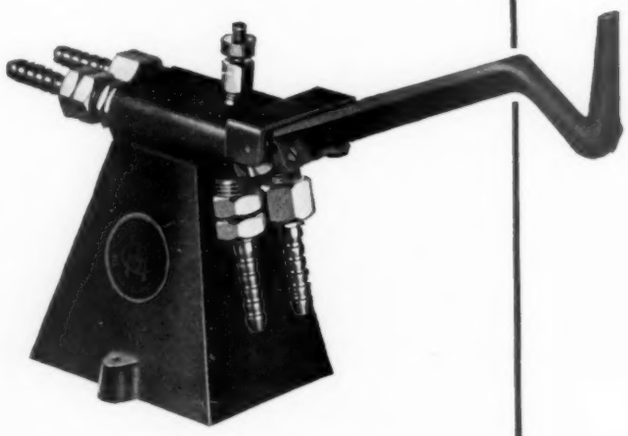

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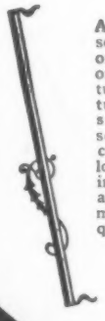

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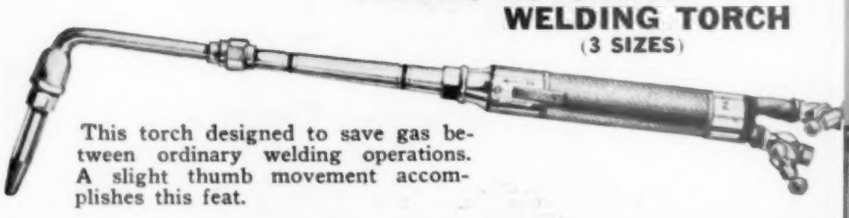

This torch designed to save gas between ordinary welding operations. A slight thumb movement accomplishes this feat.

HIEVEMENTS

and economy. On these two pages there are illustrated a few of the latest outstanding contributions to the progress of the industry.

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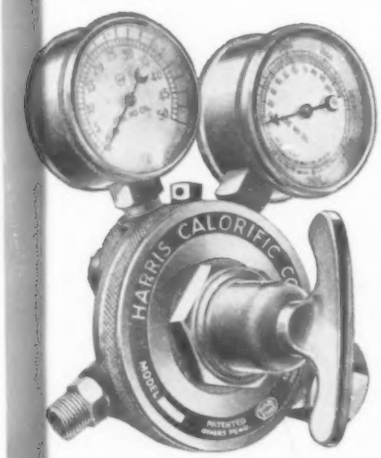

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THE WELDING ENGINEER PUBLISHING CO.

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9-24-1940

EDITORIAL

Where Welding Is a Necessity

AN approximate volume of business amounting to two hundred and fifty million dollars in ornamental iron work in 1930 is reported by Wm. A. Boesche, President of the National Association of Ornamental Iron, Bronze and Wire manufacturers. In view of the general decline in building activities this is a remarkable showing, and the Association looks forward to greater accomplishments in 1931. During the past few years the metal worker has shared more and more in the equipment of new buildings, with stairways, grills, balconies, chandeliers, etc. However, during the past few years, there was also a reported decline in building activities of more than two and one quarter billion dollars. The large business done by the ornamental-iron workers in spite of the building decline is taken to indicate the popularity of their products among builders who might have been satisfied with cheap substitutes in slack periods. The past year has proved beyond a doubt that metals are being called into increasing use in both home and building construction and decoration. A speeding up of building activity would, in Mr. Boesche's opinion, bring some swift changes in architectural style. New fashions that would otherwise receive gradual expression in normal course of building activity will be called into immediate use and the trends of today will become the realities of tomorrow. The welding fraternity will get considerable encouragement from the developments forecast for ornamental-iron workers, for the reason that there is a definite trend in this trade toward an increasing use of the welding processes for fabrication. In fact, a good many of the modern activities of the ornamental-iron worker would be either impossible or impractical without welding equipment.

B. & O. Pleased With All-Welded Hopper Car

SEVERAL favorable reports have been published concerning the all-welded hopper car which was constructed some time ago for the Baltimore & Ohio Railroad. The experience of this railroad should certainly encourage other transportation companies to look with favor on cars of all-welded construction and to give more attention to the subject of designing them in the future. It was reported that the hopper car referred to is capable of carrying a load limit of nearly twenty tons more than the standard riveted type of car. Advantages are also seen in the absence of bolts and nuts and in more economical construction. There is every indication that the welded hopper car has given complete satisfaction and is fully able to stand up under the abuse that the ordinary freight car receives.

Office Centrale Will Move This Month

ACCORDING to a recent announcement, the Office Centrale de l'Acetylene will move on January 24th, from 104 Blvd. de Clichy, Paris, to 32 Blvd. de la Chapelle, Paris, where a new building has been constructed and equipped. An interesting program has been arranged, starting at ten in the morning, including an inspection trip through the new quarters and finishing with a banquet during the noon hour. The title of the new building will be Centre de l'Acetylene et de la Soudure Autogene. It will include a large shop for study, demonstration and repair welding, a conference hall with a seating capacity of 300, a museum and a general laboratory, offices for all of the organizations which will be located there, separate quarters for a welding school which will have its own class rooms, library and laboratories, and additional rooms for special laboratories and experimental shops. The Office Centrale has done notable work in France and has contributed so much to the development of the welding processes that it deserves this opportunity to carry on its activities in more commodious quarters and with better organized facilities.

New Record Set at Power Show

OVER one hundred and thirty thousand visitors comprised the attendance at the National Power Show held at the Grand Central Palace, New York City, last month. These are record-breaking attendance figures, and officials of the Power Show state that the character of the visitors was much more valuable from a sales standpoint than ever before, basing this statement on comments made by the exhibitors. Power is the basic factor in American civilization, and firms supplying the power-plant field evidently realized that this was their opportunity to show real leadership by demonstrating to industry through carefully designed working exhibits the devices which produce efficiency and economy and go far toward curing some of the economic evils of waste. Visitors at the exhibits presented a very good cross-section of the industrial leadership of the country. Their interest in such an event and their attendance in such large numbers can safely be taken as a sign of their determination to increase their various activities during the coming year. Many of the exhibits were of a nature never before attempted, and there was obviously a great deal of enthusiasm on the part of those exhibitors who had gone to the trouble to make their exhibits mean something. Those in charge of the exhibits acknowledged freely that both the attendance and general success were far beyond their expectations. Such an expression of opinion is significant at this time, when there is a great deal of doubt mixed with a great deal of prophecy, because this intense interest in the power-plant field is a fundamental thing affecting all industries. It demonstrates as no other collection of facts could demonstrate that industrial men in America are making definite plans for a bigger year in 1931.

Save the Evidence

IN a recent address before the New York State Industrial Safety Congress, Mr. L. H. Carris, Managing Director of the National Society for the Prevention of Blindness, reported some very interesting information which had been received as a result of asking one hundred leading safety engineers what they had experienced or observed during the past year which would be valuable in the protection of the eyes of industrial workers. The thing which stands out most prominently is the success of the mandatory rule concerning wearing of goggles on specified forms of work. Toward the end of his talk he described the effect of an exhibit of goggles and glasses which had saved eyes in one plant. Almost any plant engaged in welding on a large scale could easily accumulate such an exhibit. Protective glasses which have become pitted so that they need replacement are usually thrown away. Keeping a few of these on hand might be worth while if there is any tendency on the part of welders or cutters to discount the value of the protection. Such an exhibit certainly has a place in every welding school, where every student should be subjected to rigid discipline as far as eye protection is concerned.

STOODITE OVERLAYS RESULT IN OPERATING ECONOMIES

Prior to the adoption of STOODITE this sand-sucker agitator was worn out to the point of necessary renewal each two or three days. The STOODITED agitator shown above stood the same abuse, that had formerly necessitated renewal, for thirty days of continuous service. $870.00 was the original cost of the part each time it was renewed, yet it required only twenty-two pounds of STOODITE to accomplish this outstanding performance.

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Welding Hints From California

Examples of Unusual Welded Constructions Indicate That Shops and Manufacturers Are Keenly Awake to the Development of New Designs

VISITORS to the Western Metal Congress to be held in San Francisco, February 16-20, will find some unusual and interesting applications of welding being made by manufacturers and welding shops throughout central and southern California, if their interest in the subject is enough to cause them to spend several days visiting around. Welding is playing as important a part in the industrial life of California as in any other section of the country. In this day of intense competition, Pacific Coast manufacturers are giving particular attention to developments in the welding field and investigating the possibilities they hold for cutting costs and production time. The main plants of several of the country's largest manufacturers of welding supplies and equipment are located in California; and the extensive operations of the oil producing and refining industry, together with recent distribution projects of natural gas on a large scale, have tended to keep interest in welding very much alive in the state.

Several examples of unusual applications of welding will be cited as being typical of what the interested visitor can be expected to find in California's factories and shops. The first description is that of a Diesel engine, the parts of which were arc welded together out of scrap metal.

This economical power unit,which is shown in Fig. 1, was designed by Elmer Seager, of the C & M Machine Co., of San Pedro, Calif., and was recently built by that company. It is of simple construction, and was built up of pieces of

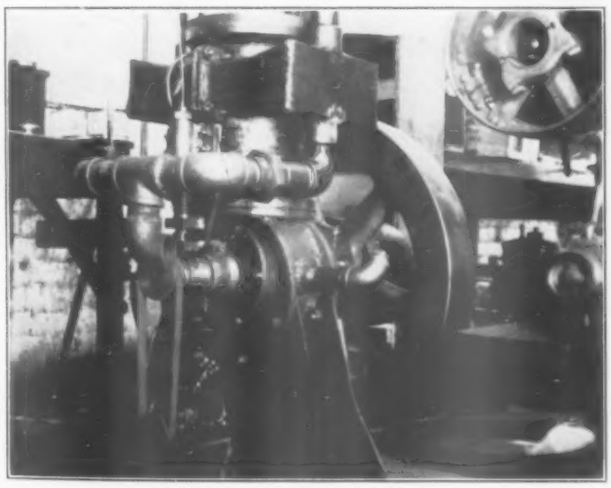


Fig. 1. All-Welded Diesel Engine Made from Scrap Pieces.

old pipe and steel plate that had accumulated about the shop. The only parts of the engine not welded are the flywheel and crankshaft; these were taken from an old marine motor. In building the engine of this inexpensive material, much pattern expense was eliminated, inasmuch as necessary changes were of little consequence in waste material.

This is a 2-cycle, solid-injection Diesel-type engine, and is estimated to develop 15 hp. It has been speeded to 1,000 r.p.m. The supporting base is of ¼-in. steel plate. The crankcase is of 10-in. pipe, with 1-in. steel plate to form the ends and to carry the bearings. The outer water jacket is of 8-in. pipe, while the inner cylinder is of 5-in. pipe turned and ground to a press fit in ribs welded into the outer cylinder. The exhaust and intake manifold is of welded steel plate with a separating partition welded inside. The fuel pump is also made up of arc-welded parts. The engine has a compression of 450 lb. per sq. in.—*with no leaks*, by reason of its welded construction.

The use of welding for fabricating road scrapers is a successful innovation of the Atlas Scraper Co., of Bell, Calif., manufacturers of welded scrapers used in road and street grading for transporting dirt, gravel, and other grading material. Fig. 2 shows one of the scraper bowls, and a view of a portion of the operating and pulling frame. These scrapers are fabricated entirely from I-beams, channel iron,

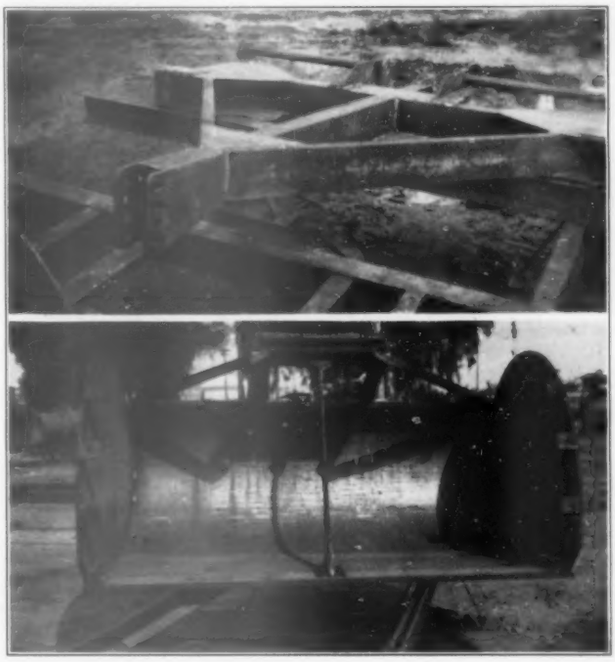


Fig. 2. The Scraper Bowl (*Below*) and Pulling Frame (*Above*) Were Considerably Reduced in Cost and Made Stronger by Changing from Riveted to Welded Construction.

angle iron and boiler plate ranging from ½ in. to 12 gage in thickness.

Until a comparatively short time ago, it was the policy of this company to punch and rivet in constructing their products. By extensive experiments and thorough tests they found that a great saving is made in cost and also added strength attained by welding, and are now using this method of construction almost exclusively. The scraper bowl is being manufactured by welding with a saving of 30% in cost and an increase of 25% in strength.

The frame, formerly riveted at a completed weight of 2,500 lb., was redesigned for welded construction and the weight thus reduced to 2,000 lb. This feature alone adds much to the ease of operation of this piece of equipment. Beside the saving in power attained through the reduction in weight of these frames, additional strength of approximately 30% was attained. A marked reduction in manufacturing costs of the frames was also realized.

This company builds both a rotary wheel scraper and a mechanically operated power scraper, driven from the power take-off at the rear end of any standard make of tractor. The advantages of the power scraper are many, the principal ones being: first, operation is easy, and second, the bowl can be rocked back when necessary for transport-

ing dirt or other material for considerable distances. Both of these types of scrapers are of welded construction in most respects, and the company anticipates the installing of additional welding equipment in the near future for increasing the welded construction of their products to 100%.

The unusual wearing quality of present-day oil-well-digging bits is the result of experiments with hard facing and the use of hard metal inserts—developments of the welding industry—which have revolutionized the oil-well-drilling industry. Until the use of hard metal inserts and facing compounds became generally known, several bits had to be changed to do the work that one bit will now do, which added a great deal to the expense of drilling.

Fig. 3 shows a special type of oil-well-digging bit, which by the application of hard metal inserts and hardfacing compound recently made an unusual record for the credit of its

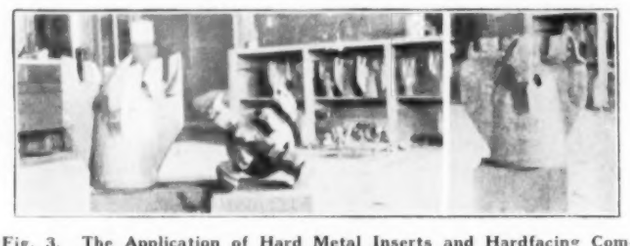


Fig. 3. The Application of Hard Metal Inserts and Hardfacing Compound Decreases the Wear on Oil-Well-Drilling Bits. The Bit Shown at the Right Had Just Set a Record of 2,565 Ft. at One Drilling.

manufacturers, the Oliver Brothers Oil Tool Co., of Long Beach, Calif. This bit was recently pulled from the bottom of a well after making a record of 2,565 ft. of hole without being removed. The bit was prepared by applying Borium inserts and facing with Borium Compound. This bit is shown in the right-hand view in Fig. 3, and a view of it lying bottom end forward is shown in the photograph at the left. A bit of the same type and size as the one making the record mentioned, built up and prepared for going into service, is shown at the extreme left of Fig. 3.

The record-making bit drills a 13½-in. hole, and was put to work at the 700-ft. level, and stayed on the bottom continuously until a depth of 3,265 ft. was reached, making the 2,565 ft. of hole in 60 hours of digging time. This record, so far as can be ascertained, is an unequalled one for any drilling bit in the oil industry. While the bit shows considerable wear, yet it was but ⅜ in. out of gage when pulled from the hole. The work was done during the month of October of last year, while drilling on Langford Oil Co.'s well No. 1, in the Venice, Calif., field.

Welding proved to be an effective means of fabricating light standards for a miniature golf course in southern California. These standards not only furnish excellent lighting facilities, but also add beauty to the surroundings, as will be noted in Fig. 4. Also by their welded construction and the inexpensive material used, they were installed at a marked saving over any other kind of equipment in their class.

The view shown is of the golf course of the popular Carlsbad-California Hotel, a beach resort near Oceanside, Calif. The standards are constructed of used pipe, and are electrically welded throughout. The bottom section, or trunk, is of 2½-in. pipe and is set in 2½ ft. of cement. The upper section is of 2¼-in. pipe, which fits nicely inside the bottom section, and the two sections are welded together. The four spreading arms at the top supporting the lights are of ¾-in. pipe, welded at the top of the pipe standard and braced by ½-in. strap iron crossed and welded between each arm in such a way as to eliminate swaying.

Wiring facilities are arranged by a slot cut out by the oxy-acetylene torch near the bottom of the standard, which, after the wiring is completed, is concealed by pieces of sheet metal fastened over the slots by bolts welded in at the top and bottom of the slots. These standards are 15½ ft. in height, and the four lighting arms extend 8 ft. out from the center. The welding was by the Oceanside Welding Works.

Fig. 5 is a view of a corner of the welding shop in the Shockey Boiler Works, of San Diego, Calif., in the foreground of which is seen an all-electric-welded hoist for use in lifting and transferring heavy jobs from one part of the plant to another. This unusual and very useful piece of welding shop equipment was designed and made by Mr. Shockey. The hoist is designed for 3-tons capacity, and is constructed of old used 4-in. oil-well drill pipe, which on account of the heavy pipe gives it much more than the intended capacity.

The hoist has a 20-ft. boom, and a 30-ft. mast. Power is by a small gasoline engine, the hanger of which is welded. The drum hanger is also all-electric-welded. This hoist is especially convenient in moving large tanks and other heavy work from one location in the shop yard to another. Mr. Shockey's plant specializes in "tailor-made" fuel tanks

Fig. 4 (*Left*). **These Artistic Welded Light Standards In No Wise Detract from the Beauty of the Well-Laid-Out Miniature-Golf Course.**
Fig. 5 (*Right*). **This Hoist Is All-Welded, Including the 20-Ft. Boom, 30-Ft. Mast, and Drum Hanger, and Is Built of Old Oil-Well Drill Pipe.**

for fishing boats and other craft of various sizes in and around the San Diego harbor.

A three-unit portable electric welding machine, consisting of three 300-amp. Lincoln machines mounted on a truck, is shown in Fig. 6. This unusual arrangement in portable welding equipment is owned and operated by the Irwin Welding Works, of Long Beach, Calif., and has seen service in every oil field in southern California. Owing to its unusual capacity for turning out work on rush jobs in oil fields, this outfit is often sent on calls covering a very wide territory, frequently going as far as 300 miles from home.

The truck, as will be noted in the illustration, is also equipped for hauling an acetylene-welding outfit, having gas-tank holders at one side to handle three tanks—two oxygen and one acetylene—with a double connection for the acetylene tank, affording two complete gas outfits. Space is also available for additional gas tanks; and frequently, when the occasion necessitates, an additional electric portable is added, making it in an emergency a four-unit portable electric in addition to the acetylene outfits.

An additional feature of this large portable welding outfit is the method of handling the electric cables. These are wound on spools conveniently located on the sides of the truck, as shown, and are grounded by fastening to the spool. Thus the cable need not be unwound for ground connection before preparing the start welding operations.

The Irwin Welding Works have been in operation for over eight years, opening for business at the beginning of drilling operations in the Signal Hill oil field. It is the largest-equipped welding concern in the field at the present time. Besides the large three-unit portable electric, they operate three other portable electric machines, as well as a number of acetylene outfits and three stationary electric machines. Fifteen trucks and service cars are in use by the concern,

Fig. 6. This Portable Welding Outfit Has Seen Service in Every Oil Field in Southern California.

which features general oil-field welding of every description, specializing on oil-well-casing jobs. By the use of the large portable outfit described in this article, they can handle oil-well-casing jobs efficiently and speedily. A special kind of oil-well casing called the American Seamless Slip-joint casing is used very extensively in this field. Instead of having threads for screwing together, the joints are welded by the electric arc as the string of casing is lowered into the well.

THIRD WELDING CONFERENCE AT AMES

The third welding conference will be held at Iowa State College, Ames, Iowa, January 21, 22 and 23. The program will consist of discussions and demonstrations of oxy-acetylene and electric-arc welding.

Some of the major subjects will be: pipe welding, welding special steels, structural welding, welding copper alloys, welded parts in manufacturing, use of bronze welding rod, hard-facing metals, causes of failure of welded joints, and cutting steel and cast iron. All discussions will be followed by demonstrations by skilled operators. Individual problems will be given careful attention.

There are no fees in connection with this meeting, and any one interested in welding is invited to attend.

WELDED STEEL TANKER OF LOCK-NOTCH PLATE CONSTRUCTION

Built by the lock-notch plate welding system developed by Richard F. Smith, the steel tanker Ira S. Bushey, which contains not a bolt, rivet or angle throughout, demonstrates that welded vessels can be constructed from model and retain designed curves and graceful lines. The vessel was recently launched from the yards of Ira S. Bushey & Sons, Brooklyn,

Fig. 1. Richard F. Smith, Inventor of the Lock-Notch Welded System.
Fig. 2. All-Welded Motorship Ira S. Bushey, in Gala Attire, Just Prior to Launching.

N. Y., well-known shipbuilders, where it had been constructed under the supervision of Mr. Smith.

Welding has added 60% or more to the strength of the vessel and has saved approximately 20% in weight and 25% in construction costs. There is no loss of flexibility and no possibility of buckling or distortion.

The vessel is 115 ft. long and 24 ft. wide, with 11 ft. draft, and has a carrying capacity of 125,000 gallons. It is driven by 240-hp. Fairbanks-Morse full-Diesel engine. It has an 8-ft. draft forward loaded, 9-ft. draft aft loaded, and 7-ft. draft when light. Constructed by Ira S. Bushey & Sons for the Petroleum Transport Co., it will be used for transporting oil.

Because of the greatly increased strength resulting from

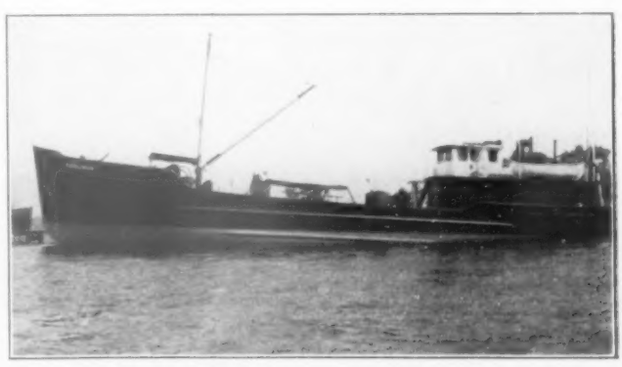


Fig. 3. The Carolinian, the World's First All-Welded Vessel for Coastwise Service, Also Employs the Lock-Notch Welded Plate Construction.

welding, a very substantial increase in load may be made. At the same time there exists less possibility of straining in heavy seas and storms. Possibility of leak is practically eliminated, as there are no caulked seams to work loose. Rolled steel plate ⅜ in. thick was used.

In the construction of the vessel, work was developed directly from the mold loft where the sections were laid down one at a time. The shapes were placed on the plates, marked, and cut out with an oxy-acetylene cutting torch. No fabrication of materials was performed.

Longitudinal framing was employed with flat bars, 5x½ in., spaced 2 ft. apart. Each longitudinal frame is complete from end to end, with frames notched approximately ¾ in., which fit into similar notches 4¼ in. deep in the transverse web plates and bulkheads and are welded together to form a lock. Longtiudinal plate seams were fitted to coincide with the longitudinal framing, and a three-part joint deep welded into the longitudinal and plate.

To fit the plates in position on the longitudinals, first a series of clips of the same material as the longitudinals, with a hole at the top, was welded to each plate. A simple hook lever held the plate against the longitudinal, which was then tack welded in place until the final welding. The clips were then hammered down and welded to the longitudinal, making extra supports 2 ft. apart the whole length of the framing. Butts of the plates were designed to come to the web frames for the purpose of welding. Horizontal bulkhead stiffeners were reeved through slots in the center-line bulkhead, permitting them to be run in one piece from side to side of the vessel. Where transverse and longitudinal bulkheads crossed, both were split to half the depth of each plate, then locked and welded on both sides of the split portion to the integral part of the plates.

Every seam in the vessel has three welds; two inside and one outside. The metallic electrode welding process was employed. Approximately 44,000 ft. of welding was required.

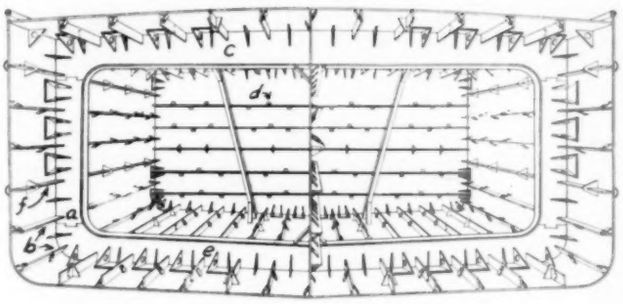


Fig. 10. Midship Section of Transverse and Bulkhead, Richard F. Smith Patented Lock-Notch Welded System.

(Legend: *a*, Dovetail weld in transverse. *b*, Longitudinals locked into transverse and bulkhead. *c*, Transverse frame. *d*, Clip used for assembly work. *e*, Bracket on dovetails. *f*, Longitudinal straddle used only on seams.)

The amount of welding wire used was roughly 18,000 lb., against an estimated requirement of 30,000 lb. of rivets for a vessel of equal size employing riveted construction. The absence of gusset plates and clip angles employed by the riveting process was a large factor in bringing the estimated saving in weight up to 20%.

The Ira S. Bushey takes its place alongside the Carolinian, all-welded motor-ship launched on February 14th at Charleston, S. C., as a convincing example of the advantages of all-welded ship construction. It is the world's first all-welded vessel in coastwise service, having received final papers early in December.

At present, three vessels employing the Richard F. Smith lock-notch welded plate system are under construction at the plant of the Charleston Dry Dock and Machine Co., Charleston, S. C. Details of their construction will be given in an early issue of *The Welding Engineer*.

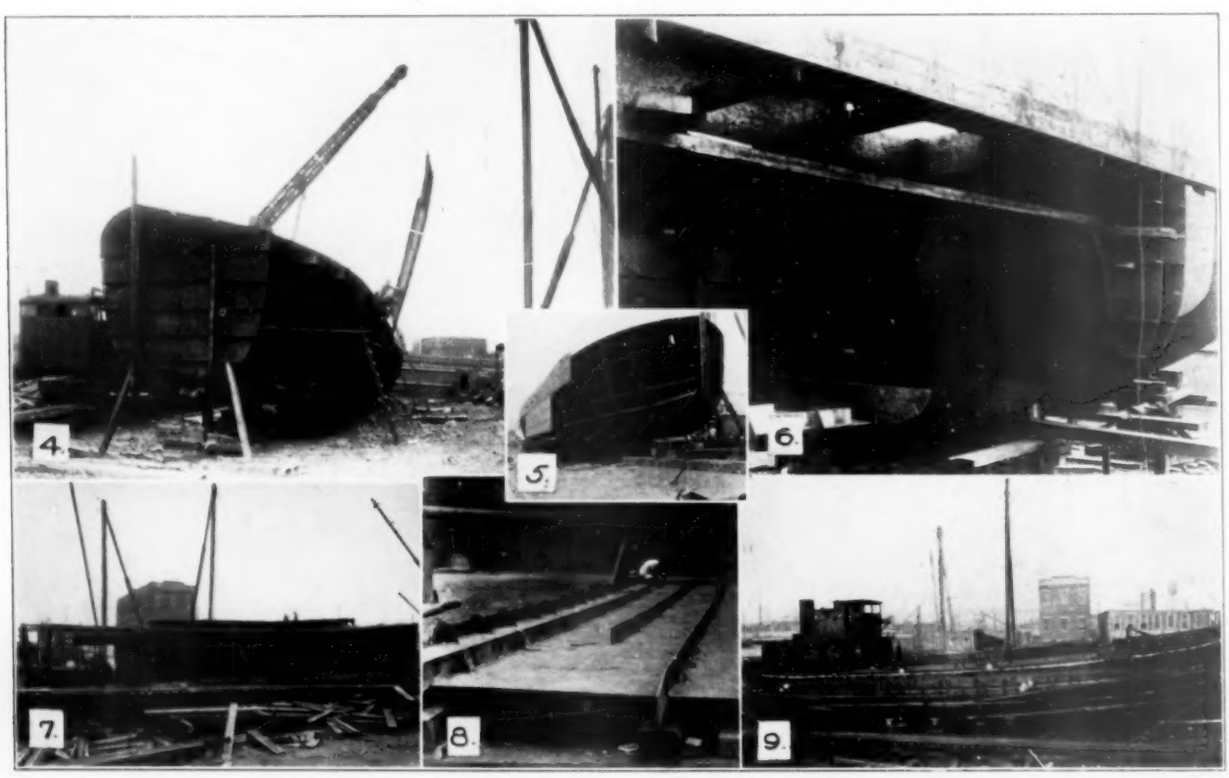


Fig. 4. Note the Extreme Width of Deck Plates Possible in This Type of Construction.

Fig. 5. Plates When Erected Are Over Fifty Per Cent Complete.

Fig. 6. Side View, Showing Center Line and Athwart Ship Bulkheads.

Fig. 7. Showing Center-Line Bulkhead Stiffening.

Fig. 8. Illustrating Longitudinal Flat Bars Locked in Place, and Welded to the Clips.

Fig. 9. Welding Crew at Work as Ship Nears Completion.

Biennial Western Metal Congress

An Educational Event Sponsored by 13 Technical Societies, Together With an Outstanding Machinery Exhibit, Will Record Advances Made in the Metals Field

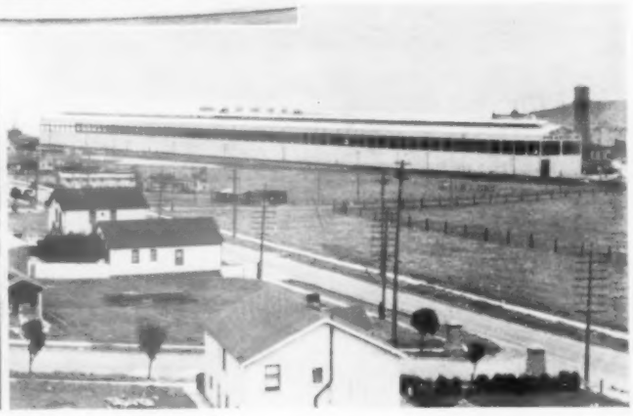
A GREAT educational event in the western metals world! This characterizes the National Western Metal Congress and Metal and Machinery Exposition scheduled for February 16, 17, 18, 19 and 20, 1931, in the Civic Auditorium, San Francisco. Thirteen western chapters of national technical societies are cooperating in the preparation of programs which will offer an opportunity for the reading output runs well over a billion dollars in value and more than one-fifth of which are engaged in international trade.

Among the many plants that have shown growth and also those that have recently established manufacturing enterprises in this rapidly growing industrial district, there are to be noted rubber and steel plants, automobile factories, large warehousing establishments, and furniture makers.

Center: **The Imposing San Francisco Civic Auditorium Building Where the Machinery Exposition Will be Held.**

Below: **A Busy Industrial Scene Which Typifies the Diverse Activities of This Region.**

Below: **One of San Francisco's Busy Manufacturing Enterprises, Which Is So Strategically Located As to Ship Economically Either by Rail or by Water.**



and discussion of papers covering the developments and new discoveries in their respective fields made during the last two years. These chapters, with a total membership of over 10,000, include the American Chemical Society; American Institute of Electrical Engineers; American Institute of Mining and Metallurgical Engineers; American Society of Mechanical Engineers; American Society for Steel Treating; American Welding Society; Institute of Metals; National Purchasing Agents Association; Pacific Coast Electrical Association; Pacific Coast Gas Association; Society of Automotive Engineers; American Society for Testing Materials; and the National Association of Power Engineers.

Rapid Industrial Development on the West Coast

It is not so many years ago that the West was known mostly for its climate, and but little mention was made of its manufacturing activities. Only as recently as the period of 1923-1925, according to census statistics, while but 14 of the 48 states showed an increase in their number of factories, nine of them were in states west of the Rocky Mountains. A later census report (1925-27) indicates that while the nation as a whole made an advance of 0.08% in volume of manufactured goods, the Pacific coast states made an advance of 4.1% and the Los Angeles district made an individual advance of 14%. There has been, in addition, a comparably large population growth during the last decade. In summing up these advances, since 1909 when the value of manufactured goods from 200 factories stood at 68 million dollars, there are today 4,600 factories whose annual

Gas and electric utilities companies have been inaugurated to furnish power for rapidly expanding needs, both in manufacturing and in lighting home and office buildings. One of the activities of this latter group has been the laying of pipe lines which has taken so much of the output of the steel plants during the past year. Bridge and building construction companies have also taken much of the output of the steel companies as well as the products of the other manufacturers in this district. Also in handling the many other commodities made, much activity is to be found in shipping which entails such projects as dry docks, ship construction, etc.

Consumers of Metals and Metal Products

It is significant that all of these manufacturers either are wider users of metal products or use metals in the production of finished goods. They rely on the welding processes either in direct production so as to turn out better goods more economically or for maintenance in keeping busy factory machinery in good working order. This, the second National Western Metal Congress with its five days of technical sessions is being sponsored to keep busy factory executives and their engineers supplied with first hand information on the advances made in their many fields during the past two years. Running concurrently with the Congress, there is also the display in the San Francisco Exposition Auditorium where many manufacturers will have their products in daily operation to show every phase of production, selection, fabrication, inspection, treatment,

welding, assembly and use of metals of all kinds. In the exhibits, which will cover over 70,000 feet of floor space executives can see equipment and what it will do under circumstances not available in any other way. Proof of the interest in an event of this kind is evidenced in the 1929 Los Angeles Show where many thousands of dollars in sales were made, although the exhibit was primarily educational.

Technical Papers

Among the technical programs, the high spots of the one arranged by the American Welding Society which will take up two half-day sessions, are a paper on "Welding Aluminum and Its Alloys" by W. M. Dunlap of the Aluminum Research Laboratories of the Aluminum Company of America. Another paper which promises to be well discussed is to be presented by J. C. Hodge, metallurgist of Babcock and Wilcox, who will talk on "Fusion Welding." Miles C. Smith will appear with a timely paper on "Welding Alloy Overlays." Numerous other papers on oxy-acetylene and arc welding will be presented during the two days.

On the Pacific Coast Gas Association program, there are such timely subjects as "Gas Furnaces for Nitriding" by J. H. Knapp of Los Angeles; R. G. Guthrie of the Peoples Gas, Light and Coke Co., Chicago will be on hand to discuss "Carburizing Steel by Gas." "Electricity in the Steel Mill" will be one paper by G. E. Stolz, Westinghouse Electric & Manufacturing Co. on the American Institute of Electrical Engineers program, while members of the A.S.M.E. will discuss "Nitriding" by O. E. Harder of Battelle Memorial Institute, Columbus. "Creep of Metals at Elevated Temperatures" will be another feature of this program and will be presented by P. G. McVetty of Westinghouse. There is so much overlap in the activities of all these sessions that many men will find much of interest in the programs outside their own direct activities.

Many Welding Exhibits

Among the exhibitors who have already reserved space there are the Air Reduction Sales Co., New York City; Allegheny Steel Co., Brackenridge, Pa.; Babcock and Wilcox, Barberton, Ohio; Brown Bros. Welding Co., San Francisco; Clark Trucktractor, Battle Creek, Mich.; Fusion Welding Corp., Chicago; Hall-Scott Motor Co., Berkeley, Cal.; R. G. Haskins, Chicago; Hauck Mfg. Co., Brooklyn, N. Y.; Johnson Gas Appliance Co., Cedar Rapids, Iowa; Lincoln Electric Co., Cleveland, Ohio; Linde Air Products Co., New York City; Norton Co., Worcester, Mass.; Republic Steel Corp., Massillon, Ohio; Stoody Co., Whittier, Cal.; Taylor-Wharton Iron & Steel Co., High Bridge, N. J.; Taylor-Winfield, Warren, Ohio; Victor Welding Equipment Co., San Francisco; Warner Engineering Co., Pomona, Cal.; The Welding Engineer, Chicago, and the American Steel and Wire Co., Chicago.

Headquarters have been opened for both the congress and exposition in the Civic Auditorium Building, San Francisco, by W. H. Eisenman of Cleveland, Secretary of the American Society for Steel Treating. Mr. Eisenman in commenting on the coming double event says that any one whose work in any way touches on the production, fabrication, inspection, treatment or welding of metals should be on hand in San Francisco February 16-20. He expects a registration of more than 5,000 delegates at the congress, and 60,000 visitors at the exhibits will not cause much surprise. This seems a conservative estimate in view of the fact that there were more than 50,000 interested onlookers at the 1929 event in addition to the fact that the Western Congress will not be held again until 1933.

AMERICAN BRIDGE CO. IS COLLABORATOR IN COLUMN-BASE TESTS

The tests of riveted and welded column bases conducted in the Bureau of Standards laboratory at Washington, D. C., which were reviewed and the results discussed on page 31 of the December issue of *The Welding Engineer*, were made possible by the active participation and cooperation of the American Bridge Co., of 71 Broadway, New York, N. Y. The design used in these tests was made and proposed, and the material fabricated and furnished, by the American Bridge Co. for this investigation, which fact was inadvertently omitted from *The Welding Engineer* article referred to above. The late James H. Edwards, one of the authors of Bureau of Standards Research Paper No. 218, which describes these tests and evaluates the results, was at that time chief engineer of the American Bridge Co.

WELDING CONTRACTORS UNDERTAKE CONSTRUCTIVE PROGRAM

The establishing of a credit-reporting service for delinquent accounts, an employment service for supplying welders, studies of costs, and the establishment of mutual confidence, are some of the accomplishments of the Welding Contractors Association of New York, Inc., which was organized last October and held its first annual meeting and election of officers in New York City on January 7, 1931. Membership includes job welders, structural welding concerns, and companies engaged in fabrication welding to order.

There has been a monthly increase in membership, which has jumped from 6 to 17 in three months. It was stated at the meeting that there is a growing appreciation among the welding contractors in the New York Metropolitan district of the necessity for cooperative activities such as the Association is undertaking.

The need of the credit-reporting service for the protection of the welders against concerns which never intend to pay their billis is indicated by the number of delinquents owing bills to two or more members. The employment service makes it possible for members to obtain welders within a few hours when required, and the cooperative spirit of the Association is shown by the willingness with which one member lends a union member welder to a fellow member who may have only intermittent requirements for a union man.

The organization has established close relationship with labor unions whose members do welding. Contact has also been established with the American Institute of Steel Construction and with the Electric Welding Section of the National Electrical Manufacturers Association for cooperative action on matters of common interest.

Cost studies are being undertaken in order to provide members with the necessary information to permit intelligent bidding. The need of increasing the efficiency of job-shop operation is also recognized and will be investigated later.

This Association is in the nature of a laboratory for developing the best practices and policies for putting the welding contractors on a sound business basis. The experience gained here will be available to those welding contractors in other centers who may desire to organize and obtain the advantages of cooperative effort being enjoyed by the welding contractors of New York. Requests for information should be addressed to Stewart N. Clarkson, Executive Secretary of the Association, 522 Fifth Ave., New York City.

The following officers were elected for the year 1931: president, H. E. James, Bournonville Welding Co.; vice-president, G. H. Evans, E-L Electric Welding Repair Co.; and treasurer, Morris Hallen, Hallen Welding Service, Inc. The Executive Committee consists of the officers and the following members: Charles Michaels, Michaels & Mourre, Inc., and John H. Folsom, Webster Repair Shop, elected to serve for two years, and A. F. Keogh, Sound Welding, Inc., and G. H. Evans elected to serve for one year.

Welding Procedure for Saw Repairing

It Is Only a Matter of Time Before Every Large Mill Will Repair Its Broken and Cracked Saws by the Oxy-Acetylene Process of Welding

THERE are three processes in use for saw welding: the electric butt or flash welding machine, the atomic-hydrogen welding torch, and the oxygen-acetylene or gas welding torch, it is pointed out in a recent report of the Lumbermen's Accident Commission. This report is compiled from questionnaires sent to twelve representative sawmill operators. The Commission making the report consisted of W. G. Collins, Union Lumber Co., Ft. Bragg, Calif.; D. S. Painter, Fruit Growers' Supply Co., Susanville, Calif.; and J. B. Clark, Hobart Estate Co., Hobart Mills, Calif. The report takes up the proper use of these various processes in saw repairing, and is herewith abstracted.

The electric butt welder is used to weld on teeth that have been broken off circular or band saws and also for joining narrow bands. The machine is devised to clamp the piece to be welded to one side of the electric terminal and the saw to the other. Alternating current of low voltage and high amperage is passed through the parts, which heats the two edges to a melting heat, at which point the machine jams the parts together. This equipment is not practicable for sawmill use.

The atomic-hydrogen-torch method, which is a very effective one for saw welding, employs an electric arc surrounded by a ball of hydrogen, which helps in preventing oxidation. This electric equipment is costly and less portable than the gas torch.

The oxygen-acetylene torch is the most practicable method for the welding of saws in the sawmill because of the low first cost, portability, and versatility.

The torch most saw welders are using is called by the equipment manufacturers an airplane torch. It is light and gives a fine-pointed flame, which is very desirable in saw welding, as it is the object not to heat any more surface than necessary.

Adjustment of Torch

Working gages are set at 5 lb.; the flame is adjusted by valves on the torch until the acetylene flame (small white cone) shows a slight brush about ¼ in. long. This flame is slightly carbonizing (denoting excess of acetylene); but from the heat generated from making the weld, carbonizing will be reduced and an almost neutral flame will result for welding, whereas a flame adjusted to neutral will become oxidizing (denoting excess of oxygen), resulting in a burned weld. The perfect combustion of these two gases creates a large outer enveloping flame of almost pure hydrogen, which protects the molten metal from the atmospheric oxygen.

Filler Rod

One of the most satisfactory filler rods is SAE 4130 (a chrome-molybdenum steel), whose carbon content is 0.35 to 0.45 instead of 0.25 to 0.35. A rod 1/15 in. in diameter is the proper size for bandsaw work. This rod is made by large alloy-steel makers and sold through supply dealers. Some use Malin's music wire (purchased at any large hardware dealer), which is less difficult to handle than chrome-molybdenum (SAE 4130) but makes as strong a weld. Good welds can be made with strips of bandsaw steel or strands from plow-steel cable.

A clamp can be had for holding the bandsaw in place while welding. It is very convenient to have some device to bring an anvil quickly in place under the weld to swage or forge the weld while hot. These clamps are made so the anvil will drop down out of the way while the heat is being applied. If the saw is left on, the anvil heat would be absorbed which would be detrimental.

Preparing Saw for Welding

Where a bandsaw has been badly pulled out due to a wreck, it should be benched, leveled and tensioned; badly bent teeth that do not show fracture can be straightened by heating. Broken teeth should be squared up parallel with the plate and the edge beveled. Cut a piece of steel amply large enough to form the tooth, leaving it in a rectangular shape; this piece should be slightly heavier than the saw plate. Bevel the edge to be welded so the two edges form about a 90-deg. angle. Place the saw in the clamp referred to, which has a setscrew to hold the piece to be welded tight up to the saw plate. Drop the forging anvil down so it does not touch, adjust the torch as described, and tack or attach the piece to the plate at the back of the tooth to hold it in place. Start the weld at the opposite end. Turn the flame on the end of the V, and when the edges begin to fuse insert the filler rod and feed into the bead of metal until a good bead is formed; move the torch slowly forward, keeping the filler rod in or close to the molten metal at all times, applying enough to fill the V above the edges at least 1/32 in. It is important not to remove the rod from the protecting flame envelope, as reinserting will allow oxygen to enter from the atmosphere, which, coming in contact with the weld, causes oxidation or a burned condition of the steel, and this is the chief cause of failures.

After welding about 1 in., bring the anvil up against the weld, draw the torch back a few inches, keeping the flame over the hot metal, and forge or hammer the bead built up until it is not quite level with the plate. Clean the unwelded part of the V free from scale, preferably with a wire brush, and proceed as before, repeating the process until the entire weld is finished. Reheat the entire weld to a bright red and hammer to the same thickness as the plate. After all the teeth have been welded, put the saw on the bottom leveling slab and heat each tooth to a very dark red and level down. The reason for this heating is to anneal the weld and steel that has been heated quite hot, as most bandsaw steel will air-harden and would be too hard. Make a template of the finished tooth desired, lay out, grind to shape with a portable grinder, and leave the tooth a little long to allow for swaging.

Welding Cracked Band Saw

Cracks in either front, back or center of the saw can be welded, and the method employed in all is about the same. Heat the metal along the crack to a dark red, and, with the anvil firmly against the saw, open up the crack by driving a blunt chisel into the crack, forming a V of about 90 deg.

In the case of an edge crack, fit a small piece of soft steel into the gullet or on the back, ½ in. wide, and hold tight with the setscrew in the clamp. Start the weld at the bottom of the crack, following the same procedure as described in tooth welding. Do not weld over an inch at a time before forging. When the edge is reached, continue welding on into the piece of steel clamped on the edge; this will insure a good weld at the very edge of the blade. Break or grind the piece off, and clean up the edge. Place the saw on the leveling slab and heat to a bright red and hammer

to about the thickness of the plate, leaving some to clean up with a file, then heat again to a very dark red. This would be the annealing heat, to make sure the spot is not hard.

Welding Full-Width Band Saw

Welding instead of brazing has been experimented with in a number of Pacific Coast mills in all widths of bandsaws from 2 to 16 in. The welding in most cases has been done by those who have had quite a little experience. The results have been quite satisfactory.

It is more difficult to weld a thin piece of steel than a thick one. On band resaws thinner than 15 gage, patience and plenty of practice are required to keep from burning the steel, as the thin sections absorb the heat so much more rapidly than heavier plate.

Cut the saw square on the ends at the bottom of the gullet, bevel the edges to a 45-degree angle, and place in the clamp so the bottom of the V is separated about 1/32 to ⅛ in.; the exact distance varies with different welders and with the width and thickness of the plate. Some welders start at one edge to weld, others start in the center of the blade. Starting in the center seems to be the best practice. The same method of welding is followed as in welding teeth and cracks, a spot about one inch at a time being welded, then forged. When starting in the center of the saw, alternate on each side of the center so as to come out even at the edges. Use the same method of heating and annealing the job after finishing the welding.

Welding Circular Saws

Cracks, either center or edge, are being successfully welded. Broken teeth can be welded by following generally the same method as with band saws.

Crack welding in circular saws presents a slightly different problem from repairing bandsaws. The plate is heavier, and its round shape causes more buckling than in the case of bandsaws, requiring more leveling and tensioning after the job is finished.

The actual welding process is the same. The crack must be ground to a V, care used to be sure to get to the bottom or end of the crack. The weld is started at the bottom and forged at every inch of the weld. If the plate buckles or bulges so much that it will not lie level on the anvil to be forged it should be allowed to cool before proceeding, but the forging of the welded part should be finished before allowing the saw to get cold. If the saw is allowed to get cold without forging the weld, it will crack or pull apart either in the old crack or alongside it. It will take experience and practice to know when and how to hammer a circular saw during and after welding.

Saw welding is still largely in the experimental stage, but it has gone far enough to be recognized that it is only a matter of time when every large mill will require that the filer know how to repair his saws by welding. It has been said that successful saw welding is 80% skill and 20% good equipment. The saving in saw costs to the mill owner is so apparent that it needs no discussion, but there is also another factor of gain to the mill operator and filer that is not generally recognized. A good filer will get cracks in bandsaws. If he does not get an occasional crack he is putting up a safe saw which will not cut the maximum amount of lumber. The filer who can weld his saws will take more chances by carrying the tension out to the edge of the saw, resulting in cutting more and better lumber, and when he gets a crack it can be welded.

G.P.A. TO DISCUSS SALES METHODS

The annual mid-winter meeting of the Gas Products Association will be held at the Sherman Hotel, Chicago, Ill., on January 27th and 28th. The general subject of the meeting will be "Possibilities of Increasing Sales of Oxygen, Acetylene, Hydrogen and Gas Welding and Cutting Apparatus and Supplies During the Coming Year."

A particularly interesting feature of the program will be a series of actual demonstrations of correct sales presentations of these products to the customer. The purpose of this is to stimulate a more careful study of the requirements of the customer and an intelligent presentation of gas welding and cutting processes to buyers.

Also, special promotion methods for the industry will be discussed, and merchandising talks will be given by several nationally known authorities.

TRAINING MEN FOR PIPE WELDING

In the belief that local associations and groups of individual members of the Heating and Piping Contractors National Association will want to set up a definite and specific training program in welding for steamfitters, some suggestions have been prepared by John H. Zink, Chairman of the Committee on Welding, and S. Lewis Land, Director of the Educational Department of the Association. These suggestions are based upon a set of five recommendations for minimum standards which have been formulated by the Committee on Welding. These recommendations are:

1. Instructions should be given first to journeyman fitters.
2. School authorities should furnish adequate accommodations for instruction.
3. Competent instructors should be employed.
4. The course of study should be approved by the Association and based upon the use of the Standard Manual prepared for this purpose.
5. The school where training is done should keep in close touch with the industry.

With these standards as a basis, definite methods for setting up a training program have been worked out. For example, with respect to the organization of evening classes for journeymen, the following suggestions are made:

1. If the city is one in which union labor is employed, it will be desirable to appoint a committee of, say, three to cooperate with a like committee from the local union in formulating plans for the organization of the class, and rules and regulations governing the organization and maintenance of the class, and to cooperate with the instructor or other school officials throughout the period of the organization and development of the training program.

2. If the city is one where no union labor or very little union labor is employed, the committee from the local association will be fully responsible.

3. If the city is one in which there already exists in the local public schools a vocational training program or one in which there is a possibility of the organization of such vocational training, contact should be made by the joint committee from the association and union or by the committee from the association to ascertain if cooperative relationships can be established, and the class organized as an evening trade extension training program under the auspices of the Board of Education, which would provide finances for the program, including the instructor's salary and room and equipment. In many cases, supplies will need to be furnished by the association or union or both, or through a fee which will be charged each member taking the course.

4. If, for any reason, cooperative relationships cannot be established with the local Board of Education or if such funds as mentioned in Section 3 are not available, the committees mentioned in Sections 1 and 2 should be appointed and the program organized and maintained under the direction of the local association or the joint direction of the local association and local union, depending upon local conditions.

5. After preliminary arrangements are completed for the organization of the training program and committees appointed and contacts made with school authorities, plans

should be made for the adequate equipment of the class rooms and shops. The Educational Department of the National Association will be glad to assist in making such plans and in providing information concerning equipment and supplies.

6. At this stage, arrangements should be made for instructional material to be used in the training program. The Standard Manual on Pipe Welding, now in process of preparation by the Association, will be ready for distribution early in the fall. It is suggested that the committee representing the association and union arrange for every member of the class to be supplied with a manual.

7. In the development of this program, an organized systematic method should be set up for the selection of those who will take the training. It is suggested that the same committees mentioned in Sections 1 and 2 be made responsible for approving every candidate for training, and that employers who desire certain fitters employed by them to be trained as welders submit their names and information concerning their qualifications to this body, who will pass upon and approve or reject them as members of the training course. The local union, as well as individual journeymen, should likewise make such application concerning any individual desiring entrance into the training program.

8. The promotional work by the committee or committees, as mentioned in Sections 1 and 2, from this point becomes one of keeping a close contact with the program to insure its safe and sound development and continued maintenance.

Detailed suggestions have been prepared to show the ordinary requirement and floor space and equipment of a welding school. The course itself is outlined in the Standard Manual on Pipe Welding, which has been prepared by the association. This Manual is divided into five parts, as follows:

PART ONE—Introduction

I. Development of Oxy-Acetylene Pipe Welding.
II. Process of Oxy-Acetylene Pipe Welding and Cutting.

PART TWO—Apparatus and Supplies

III. Apparatus and Equipment
  Unit 1. Regulators.
  2. Welding torch.
  3. Cutting torch.
  4. Acetylene generators.
  5. Welding and cutting accessories.
IV. Welding Materials and Supplies.
  Unit 1. Oxygen.
  2. Acetylene.
  3. Welding rod.

PART THREE—Mechanics of Welding

V. Assembly, Adjustment and Maintenance of Apparatus.
  Unit 1. Setting up welding and cutting unit.
  2. Adjustment of pressures and flames.
VI. Cutting.
  Unit 1. Cutting pipe.
  2. Cutting bevel on pipe.
  3. Cutting branch openings.
VII. Pipe Welding.
  Unit 1. Making a rotating pipe weld in horizontal position.
  2. Making a position weld in horizontal pipe.
  3. Making a weld in vertical pipe.
VIII. Testing Welds and Workmanship.

PART FOUR—Material and Data on Welding Construction

IX. Designing, Laying Out, and Fabricating Welded Pipe Joints and Fittings.
  Unit 1. Line or pipe welds.
  2. Fittings and bends.
  3. Branches.
  4. Flanges.
  5. Reducers.
  6. Plugs and caps.
  7. Pipe headers.
X. Application of Welding to Pipe Installation from Design Standpoint.
XI. Management, Shop Fabrication, Personnel, and Material Distribution.

PART FIVE—Appendix

XII. Specifications and Standards Covering Workmanship, Design, and Construction of Welding of Steel and Wrought-Iron Pipe.
XIII. Engineering and Practical Data.
  Unit 1. Pipe.
  2. Flanges.
  3. Short-Radius Fittings.
  4. Pipe bends.
  5. Pipe-cutting-templet dimensions.
  6. Strength data on welds.
  7. Flow efficiency.
  8. Cost data.
XIV. Precautions and Safe Practices.
XV. Glossary of Important Terms.
XVI. An Outline for Instructors of Welding.

ARMCO MAGAZINE CONTAINS ARTICLES PERTAINING TO WELDING

Choice of material and construction of galvanizing pots, the construction and laying of a mile-long welded pipe of corrugated iron sheets for Georges Claude's power project off the coast of Cuba, and the experimental metal-base highway near Springfield, Ill., are discussed and illustrated in *The Pure Iron Era*, Third Issue, 1930, published by the Armco International Corp., Middletown, Ohio.

Franz Hausmann, the author of the article on galvanizing pots, points out that in riveted construction the rivet lines lose their temper rather quickly and the molten zinc eats the metal out around the rivet holes and then attacks the rivets. Spelter pots are being manufactured by spot welding, but data on results are so incomplete that definite conclusions cannot yet be drawn. The majority of such equipment, says Mr. Hausmann, is now being welded either by water gas or oxy-acetylene. The use of corner seams is defended as being less costly; and it is pointed out that while the spelter-pot metal is attacked more quickly at the corners than on the plane surfaces, a sound weld will often resist the action of the molten zinc better than the sheet metal itself, hence the metal may be gouged out deeply on both sides of the weld but the weld itself will remain intact.

A patent is described based on the fact that by heating the entire interior surface of the metal sides of the spelter pot to the point of fusion by means of a blow-torch, the fused surface of the plate is characterized by the same texture as that of a weld and better resists the action of the molten zinc.

An interesting description is given of the 6-ft. pipe used in Claude's project whereby he generates power by taking advantage of the difference in temperature between the warm surface water of the ocean and the cooler water lying at a considerable depth. This article is interestingly illustrated. The 7-gage Armco plates forming this pipe were corrugated and then fabricated into sections, which were riveted and then welded to secure absolute water-tightness. The attempt to float such a great line into place prior to sinking it to the ocean bed was a difficult task, and not until the third trial was it successfully accomplished.

TEXAS BRIDGE HAS BATTLEDECK FLOOR

An unusual type of bridge construction, employing an arc-welded battleship-deck floor, was recently demonstrated with the completion of a bridge over Taylor Bayou in Jefferson County, Texas. This type of floor construction is gaining in popularity for use in buildings, and it has been applied to a number of bridges.

This new bridge consists of a swing section 161 ft. long, which is now complete, and two approaches 134 and 96 ft.

Fig. 1 (*Top*). Swing Section of New Bridge, Showing Edges of Plates Turned Up Along Sides of Roadway.
Fig. 2 (*Bottom*). Arc Welding the Plate Into Place on the Floor Stringers.

long, which are to be constructed in the future. The swing section, shown in Fig. 1, was constructed by the Coastal Construction Co., of Orange, Tex. The bridge forms part of a highway between Port Arthur and Galveston, Tex., and spans a bayou near the Gulf of Mexico at West Port Arthur. It was constructed to conform with the State Highway Standards—that is, to maintain a live load of 150 lb. per sq. ft. and a dead load of 15 tons.

The floor of this bridge is fabricated of ½-in. Diamond floor plate arc welded into place, as shown in Fig. 2. The swing section covers an area of approximately 3,200 sq. ft. and is fabricated of plates 20 ft. long by 4 ft. wide. These plates are spaced ½ in. apart for arc welding to the flanges of the floor beams. The roadway is 18 ft. wide, and on the sides the plate turns up a distance of 1 ft. to form the curb, as shown in both illustrations. Thus the cross-section of the roadway is U-shaped. The floor is made strong and rigid by arc welding the plate to the flanges of the floor beams on the under side with fillet welds 3 in. long, spaced on 9-in. centers.

The under structure consists of two plate girders on each side and eight longitudinal floor beams. The plate girders are built up from 5/16- and ⅜-in. plate and 5x4-in. angles, with ⅜-in. plate 18 in. wide tack welded to the angles to form the flanges. The depth of this girder tapers from 6 ft. at the center of the bridge to 30 in. at the ends of the swing section. All permanent stiffeners on the girder are arc welded into place. The floor beams on the bridge are 18-in., 52-lb. I-beams, and the stringers are 10-in., 21-lb. I-beams.

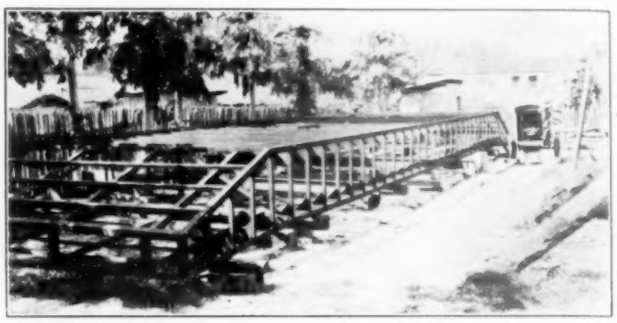
The proposed approaches to this bridge are to be completed in the future. The existing approach on the north side is 88 ft. 7 in. long, while the proposed approach will be 96 ft. On the south side the present approach is 136 ft. 5 in., while the new one will be 134 ft.

The arc welding on the bridge floor was done with the Lincoln "Fleetweld" process of manual welding, a development of the Lincoln Electric Company, Cleveland, Ohio.

ALL-WELDED BOAT FOR NAVIGATION ON MEXICAN RIVER

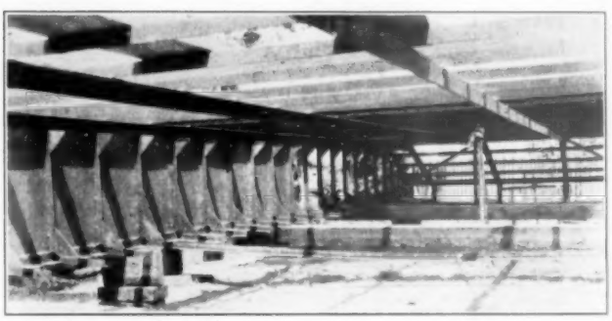
By G. Mitton

The flat-bottom boat shown in the illustration is 59 ft. long, 15 ft. wide, and 39 in. high, and is built of angles and plates, all cut to size with the oxy-acetylene torch and welded



General View of Frame of Boat, Welded Upside Down.

with the electric arc. This boat is to be used on the Panuco River, which is so low about six months of the year as to interrupt the navigation of large boats between El Higo and Panuco. The welded boat will be able to handle traffic



Inside View of Frame, With Some of the Plates Welded On.

during the low-water period, since it can be navigated in 27 in. of water when carrying a load of 40 tons. This boat was constructed face down to avoid the necessity of welding from bottom to top, and then was turned right-side-up for finishing the cover.

Completed Boat Afloat on the Panuco River.

Resistance Butt Welding of Tools

The Problem of Uniting Dissimilar Metals in the Construction of High Grade Tools Is Solved by the Resistance Butt Welding Method

THE making of twist drills, knives, shovels, and other tools and articles of this nature, is a field of manufacture to which electric resistance butt welding can be very logically applied.

In the case of tools requiring a wearing or cutting edge, this part must be made of a high-carbon or tool steel to withstand the type of service to which it is subjected. On the other hand, for that part of the tool into which a handle fits, or where it is chucked into a machine tool, a low-carbon grade of steel is desirable both from the standpoint of economy and the fact that the low-carbon steel is more ductile and therefore better for the purpose.

"Flash Welding" Drills

For years twist-drill manufacturers have been employing "flash" butt welding for combining parts made of dissimilar steels. Fig. 1 shows samples of butt-welded drills made by prominent drill manufacturers. In the making of the taper-shank drill, A shows the body of high-speed steel "flash" welded to the high-carbon shank; at B the body and neck

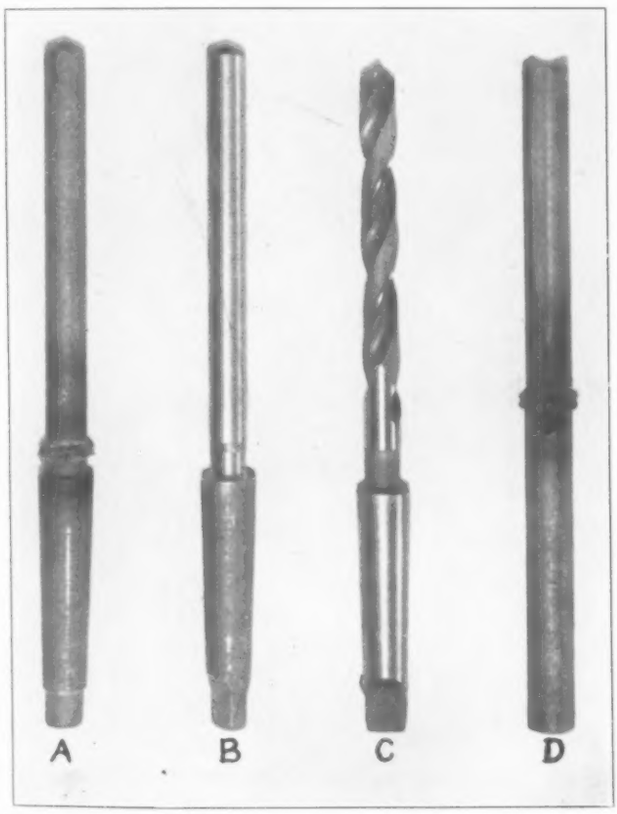


Fig. 1. A Butt-Welded and Milled Taper-Shank Drill Is Shown in Three Stages of Manufacture, at A, B and C. A Straight-Shank Drill, Before Heating and Twisting, Is Shown at D.

have been rough turned and the flats of the shank have been milled; the spiral groove is then milled, and the finished drill appears as shown at C.

A straight-shank type of drill is shown at D, this consisting of a high-speed body that is resistance butt welded to a high-carbon-steel shank. Subsequent to welding, the tool is heated and twisted in a special machine, producing a spiral groove, then finish machined and ground.

A welder for precision tools, such as drills, reamers, broaches, surgical instruments, and edged tools of various kinds, is shown in Fig. 2. This machine employs a principle in design not heretofore used in welder construction and which allows the welding of pieces of similar diameter within a limit of 0.001 in. for long periods without readjustment or realignment, provided the pieces themselves are held within this limit in size. This principle is the same as that used in

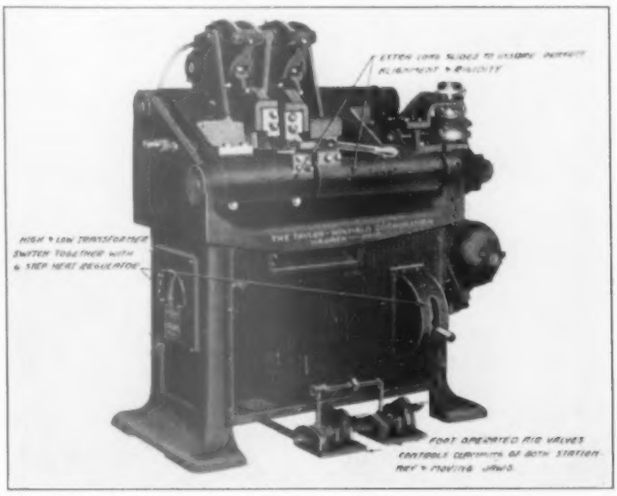


Fig. 2. Butt Welder for Drills and Other Precision Tools.

die work, in which two hardened and ground guide bars are pressed into the bolster plate, or die proper, and the punch holder is aligned perfectly with the die by sliding on these two guide bars. Thus perfect alignment is attained regardless of the ways of the punch press or the force being applied to the punch holder. In the design of this welder, two hardened and ground bars, 2½ in. in diameter, are held firmly in one casting at each end of these slides. This machine is especially fitted for the welding of high-speed steel drills to steel shanks or of high-speed-steel reamers to mild-steel shanks, as well as the welding of broaches to mild-steel shanks or other types of cutting tools having a diameter not greater than ⅝ in.

In actual production, on the first speed the cycle of this welder is 6.7 seconds and the actual welding time is 5.6 seconds. In second speed, these figures are decreased to 6.0 and 5.0 seconds, respectively; and at high or third speed the cycle is 5.4 seconds and the actual welding time 4.5 seconds. Taking these figures as a basis and allowing 8 to 10 seconds for loading and unloading each individual piece in this machine, one finds that a welding speed of 200 to 300 pieces per hour might be attained. The speed largely depends on how fast the operator can insert the pieces to be welded and remove them after welding.

Welding High-Carbon to Low-Carbon Steel

The butt welding of shovels presents another case involving the combining of two dissimilar steels. Fig. 3 illustrates the low-carbon-steel back strap butt welded to the high-carbon-steel blade, and Fig. 4 shows the weld ground smooth. No trace of the original joint is visible. This operation is performed at the rate of six per minute by means of the welder shown in Fig. 5. The method of clamping embodied in

this machine makes unnecessary the notching of the blade to create an equal cross-section, thereby eliminating this operation. The machine pictured is equipped for manual upsetting, or push-up, but can be supplied with the latest types of automatic push-up.

The welding of this shovel back strap is a preliminary production procedure. The next operation is the welding of a front strap, which in many cases is done with a modern resistance roll welder. With both back and front straps in place, the shovel blade and straps are then formed into proper shape.

Development of the welding art not only has permitted the shovel manufacturer to make his product more economically, but also has improved his shop conditions by eliminating the smoke and dirt which accompanied the forge-and-hammer method of welding.

Fig. 3. At the Left Is a Completed Shovel, While the View Above Shows the Back Strap Butt Welded to the Shovel Blade Before Forming.

The purpose of this article is not so much to give the details of the manifold operations incidental to the manufacture of tools, as it is to call attention to the wide field of application of electric resistance welding to this class of manufacturing, especially "flash" butt welding.

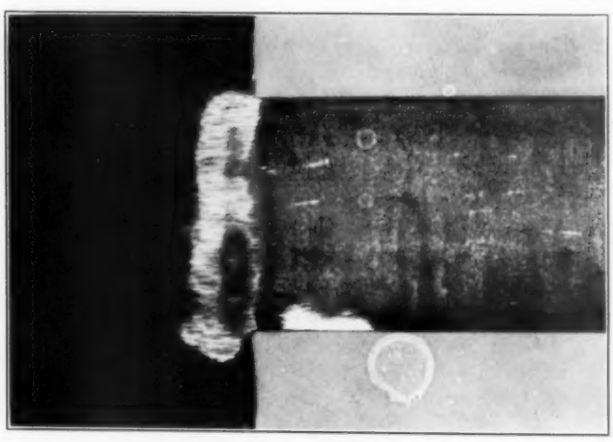


Fig. 4. A Close-Up View of the Ground-Off Weld Between the Shovel Blade and Back Strap.

To those manufacturers who are still skeptical as to the practicability of the resistance butt welding of high-carbon and tool steels to low-carbon steel, this article should give enlightenment. It might also be added that some of the cutting metals put out under various trade names can be successfully "flash" butt welded. This is a subject that merits the investigation of many manufacturers.

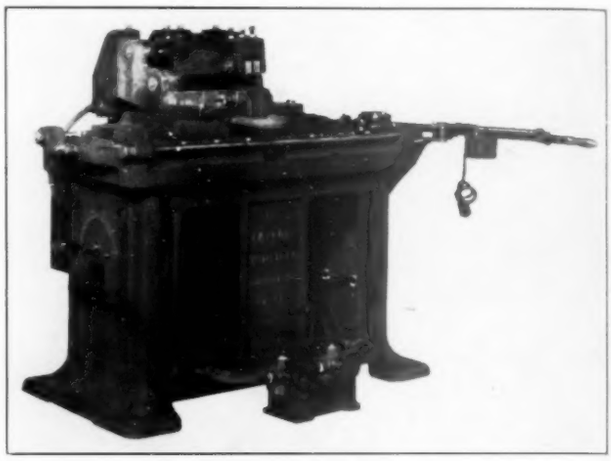


Fig. 5. This Machine Welds Six Shovels Per Minute.

Acknowledgment is due W. F. Pravel, southwestern manager, The Taylor-Winfield Corp., for supplying information on which this article is based.

LARGE WATER-SUPPLY LINE IS WELDED

The phenomenal growth, both in territory and population, of the city of San Diego, Calif., within the last 20 years has repeatedly brought that city face to face with a problem of furnishing a water supply in keeping with its rapid development. This city recently made its third major improvement since 1914, this being the construction of a large water-supply line known as the Otay-San Diego line, which is to bring water from the Otay Reservoir a distance of approximately 19 miles.

Fig. 1. This Welded Pipe Line Replaces a Smaller Wood-Stave Line.

This new steel pipe line is to replace a wood-stave line which has been in service since 1901. It will have a somewhat greater carrying capacity due to its larger diameter and greater pressure capacity. The new line will bring water directly from the Otay Reservoir to the University Heights Reservoir, and indirectly from the Morena and Barrett Reservoirs on the Cottonwood River and the Lower Otay Reservoir on the Otay River. The old wooden line had a capacity of 10,000,000 gallons daily, but improve-

ments at the Morena and Barrett reservoirs make it necessary for the new line to handle about 17,000,000 gallons daily. In the future booster pumps will be installed to increase this capacity to 25,000,000 gallons per day, or 2½ times the present capacity. Fig. 1 shows the new steel pipe being laid, and a section of the old wood-stave line.

Approximately 86,000 linear feet of arc-welded steel pipe will be used in this new water line. About half of this footage will be 40-in. pipe and the other half 36-in. pipe. Plate of 3/16, ¼, 5/16 and ⅜ in. in thickness is used in the fabrication of this pipe. These varying thicknesses are necessary to meet the varying pressure requirements. All the pipe used in this line is manufactured by the Western Pipe & Steel Co., of San Francisco, Calif.

In the construction of this line it was necessary to tunnel through 4 large hills. These tunnels were cut 6½ ft. high and 6 ft. wide. The longest tunnel is 2,150 ft. long. The welding was done outside the tunnel, as shown in Fig. 2.

All the pipe used in this line, with the exception of that for the tunnels, was dipped in hot asphaltum and wrapped with special felted fabric. The pipe for the tunnels were dipped but not wrapped.

When the city of San Diego asked for bids for the pipe, specifications for three kinds of pipe were invited; that is, for electrically welded steel pipe, cast-iron pipe, and concrete. No bids were received for concrete pipe, and only one for cast-iron pipe. It is presumed that this is due to the varying and high-pressure heads encountered on the line, and the difficulties presented by the rugged characteristics of the terrain. There were a great number of horizontal and vertical angles in the line. It is estimated that the savings afforded by the welded steel pipe if placed at

Fig. 2. Welding a Section of Pipe for a Tunnel.

compound interest would amount to a sum sufficient to duplicate the line in 12 years. This carried on for the life of the pipe, which is estimated to be between 40 and 50 years, would mean a total saving of several millions of dollars.

The pipe is equipped with bell-and-spigot joints. On the heavier pipe two beads are used, and all joints are welded on both the inside and the outside. The pipe sections as a general rule are about 30 ft. long, but vary with the terrain. The pipe is lined up and arc welded in sections, then tied into the main line. "Stable Arc" welders, manufactured by The Lincoln Electric Co., Cleveland, Ohio, were used.

The use of arc welding is resulting in a low-cost, strong, and rigid pipe line. In a test of 10 miles of this line, during construction, only one major leak was found. The sharpness of the turns and the roughness of the terrain presented no difficulty for this type construction, and required no special precautions or specially constructed pipe.

BRIDGE IS MADE SAFE BY WELDING

A repair of one of the spans of the U. S. Government bridge over the Mississippi, connecting Iowa and Illinois at the Tri-Cities, was recently completed. Reinforcement gusset plates were welded on at the ends of the top chords to strengthen

This Bridge Was Strengthened by Welding Gusset Plates Onto the Top Chords.

the structure, which work was performed by the Moline Welding Shop, Moline, Ill., the manager of which is Mr. Gustafson. The welding contract was let by F. K. Ketler, of Chicago, who held the general contract for the repair. A portable gasoline-driven electric welder was used, and at times as much as 400 ft. of cable was reeled out. The span repaired was at the Illinois end of the bridge, and is shown in the photograph.

MEASURING SURFACE TEMPERATURES

A surface thermometer of the thermocouple type, which has been successfully used for measuring the temperatures of steel rails during the periods of heating before and after welding, is described in Bureau of Standards Research Paper No. 231, entitled "Measurement of Surface Temperatures," by Wm. F. Roeser and E. F. Mueller, copies of which may be obtained from the Superintendent of Documents, Washington, D. C., at 10 cents each. This contact pyrometer was designed and constructed some years ago at the National Bureau of Standards at the request of the Joint Committee on Welded Rail Joints, American Bureau of Welding, and has proved satisfactory for measuring the temperature of stationary metallic surfaces up to 1,300 deg. F. The use of this device and its calibration are described.

This surface-type thermometer is not satisfactory for temperature measurements at 400 deg. or lower, and for this purpose a compensated type of thermocouple was developed, which is described. Results obtained in measuring the temperature of a drying roll by means of this compensated thermocouple are given.

PHOTOGRAPHING THE FLOW OF METAL IN THE ARC

Probably one of the most interesting forms of investigation of arc-welding phenomena is that of obtaining motion pictures to show what happens while the metal from the electrode is being deposited. A few years ago, a motion picture taken of a film which is sensitive only to infra-red light was produced in America. Some time later, investigators in Germany produced motion pictures of the shadow of the arc deposit taken at a very high rate. Early last year there was shown at the annual spring meeting of the American Welding Society a motion picture made by Lucien Bull, Director of the Marey Institute in France. These pictures were taken at the rate of sixty to eighty exposures per second; and as in the case of the work done in Germany, the pictures were taken of the shadow instead of being made directly from the arc itself. There has been a considerable amount of curiosity regarding the method

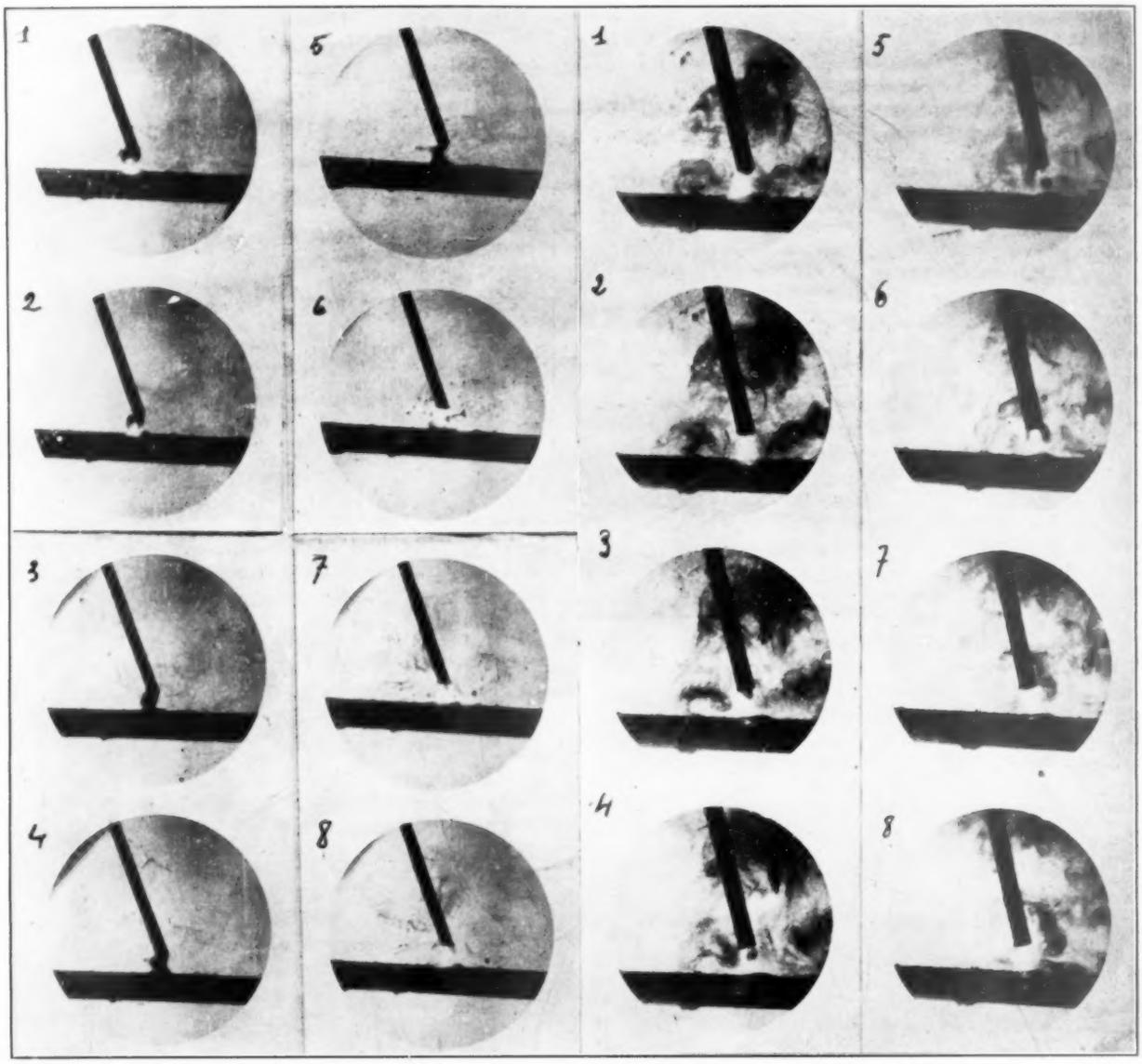


Fig. 2. Photographs of Metal Flow, Showing Eight Phases of Deposition With a Thinly Coated Electrode and Short Arc (Left) and a Thicker-Coated Electrode and Longer Arc (Right).

used in this work. Through the courtesy of Jean Brillié, of La Soudure Autogene Francaise, Paris, France, we are able to reproduce Fig. 1, which is a diagram of the method, and Fig. 2, which shows some typical views cut out from the film.

As indicated in Fig. 1, the arc-welding operation is positioned between two protective sheets of glass. The direct rays of the sun fall on a mirror placed at the left, and are reflected through a lens and onto a screen placed beyond the arc. The motion picture camera is shown at the right of the diagram. This is focused so as to pick up the image or shadow from the screen.

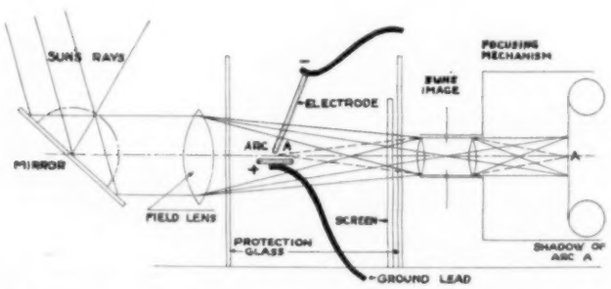


Fig. 1. Illustrating Method of Photographing Flow of Metal From Electrode.

Fig. 2 illustrates two different conditions of welding. At the left is a group showing eight different phases of the deposition of a drop of metal from a bare or thinly coated electrode with a short arc. The group at the right shows eight phases in the deposition of metal from a more heavily coated electrode and with a longer arc length.

Motion pictures taken in this manner have been used by French investigators to study the effect of variations in the coating and variations in the size and shape of the electrode as shown by the action of the metal while it is being deposited and the behavior of the arc flame during the welding operation.

In his book on "Electric Arc Welding and Its Applications," Maurice Le Brum states that by combining the work of motion pictures with oscillograms they have been able to make considerable progress with the study of the effect of changing the direction of the current and of the value of frequency in the case of alternating-current arc welding.

An American investigator in welding-arc cinematography has expressed hope in the possibility of combining the spectrum of the arc with oscillograms and motion pictures which would allow the setting up of a general equation for the arc flame.

Success of Gas Welded Pipe Lines*

Composite Construction Procedure Has Been Developed for Large Diameter Lines Which Makes High Operating Efficiencies Possible

By G. O. Carter† and T. W. Greene‡

DURING the past year of rather marked industrial depression, particularly in the steel industry, the one outstanding bright spot has been the unprecedented demand for line pipe and the construction of pipe lines. Accompanying this activity, there has, of course, been a very extensive application of oxy-acetylene welding in this industry. The year has witnessed the starting of several of the largest and longest lines in the world and has been accompanied by an extremely broad activity in the welded construction of numerous lines throughout the whole country.

To review adequately the success of oxy-acetylene welding of pipe lines, it is necessary both to review the history of welding and to present the statistical growth of the pipe-line industry itself. The construction of pipe lines may be divided into the two major divisions of oil and gas; although a third classification, of gasoline transmission lines, has assumed and promises to become a major field in the future. To date there are approximately 99,000 miles of oil trunk and major gathering lines in the United States. There are, in addition, also about 57,000 miles of natural-gas lines. Since the laying of the first high-pressure oil line, extending from Cherokee Station, Oklahoma, to Bartlesville to carry 700-lb. pressure, built in 1919-20 by Noah Wagner, Superintendent of Welding of the Prairie Pipe Line Co., who was awarded the Morehead Medal by this Association, the growth and application of oxy-acetylene welding to oil pipe lines has been phenomenal. During the last five years, when construction of these lines has been greatly accelerated, welding has been almost exclusively used as standard.

To illustrate the extent and magnitude of the oil lines even in localized sections of the country, Fig. 1 is presented showing the transmission lines from the Hendricks, Yates, and other west Texas pools to refineries in Oklahoma and to tidewater. From these pools there are ten major systems to date, some of which are looped with three parallel lines, having a capacity of over 300,000 barrels per day. All these lines are welded and, with the exception of one, are oxy-acetylene welded. Extensive as this mileage is, potential capacity of the fields, which ultimately must be provided with pipe-line facilities, will demand the laying of two and possibly three times the present number of lines.

Gas-Welded Lines Record Few If Any Joint Failures

The whole history of oxy-acetylene welding of oil lines, including as it does literally tens of thousands of miles carrying pressures of 750 lb. and higher, has been exceedingly gratifying. There has rarely, if ever, been a failure of the joint. In fact, there are several existing systems involving 3,000 miles or more in which a joint failure has yet to be experienced. Millions of barrels of oil have been and are being transported without the loss of a single barrel. The oxy-acetylene-welded joint has indeed proved to be a very economical and thoroughly reliable pipe joint for oil transmission.

Due to the conservation policy in oil production and the proration of the large oil pools, building of long transmission lines during the year 1930 has been somewhat limited as compared to the prior two years. There have of course been the usual building of short lines and the gathering and extension of existing oil-transportation systems to the new fields—for example, to the Oklahoma City pool and the Hobbs field in northeastern Mexico. There have, however, been two major installations—the Ajax pipe line, a twin or double 10-in. oil line, about 750 miles, running from Oklahoma to St. Louis, and the Gulf Company line extending from Oklahoma to Pittsburgh. Oxy-acetylene welding is used exclusively in the former and extensively in the latter.

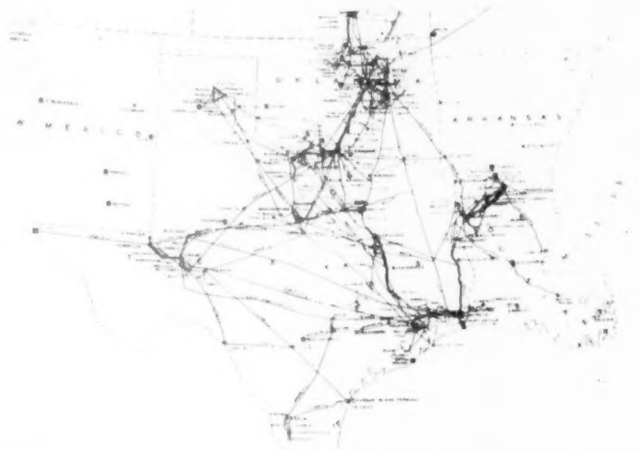


Fig. 1. Showing Routes of Pipe Lines Conveying Oil from Western Texas Fields to Oklahoma Refineries and to Tidewater.

The most important activity in the pipe-line industry the past year has been the phenomenal development and construction of gas lines, to some extent for the transportation of manufactured gas, but principally for the transmission over long distances of natural gas. Only a few years ago the transportation of natural gas for, say, 250 miles, was regarded as a wonderful achievement. The year 1930 has witnessed the starting of building of enormous lines, 22 to 24 in. in diameter, running over 1,000 miles in length, in order to make available to communities in Illinois, Minnesota, and Indiana the cheapest and cleanest of fuels produced in the gas field of the Panhandle section of Texas and other Mid-Continent fields. Three major 24-in. lines have been started from the Panhandle field the past year; one of these to the Omaha and south Nebraska regions; another, the Amarillo to Chicago line, being built by the Continental Construction Co. for the Doherty-Insull interests and other companies; and the third one by the Missouri-Kansas Pipe Line Co. to Indianapolis and other towns in Indiana and Kentucky. With the exception of the first line, which was constructed with rubber couplings, oxy-acetylene welding was used extensively in the construction of these large-diameter major projects, the lines being built by what is known as composite construction, in which two to three or more joints are welded together and then coupled.

Oxy-acetylene welding has offered to the gas, as well as to the oil industry, an economical and leak-proof joint that has proved highly satisfactory. Any review of published statistics on leakage will reveal the success of welding in reducing leakage to a negligible figure; in fact, leakage as low as 10,000 cu. ft. per year per mile per 3-in. equivalent has

* Read before the 31st annual convention, International Acetylene Association, held at Chicago, Ill., November 12-14, 1930.

† Consulting Engineer and ‡Engineer, Development Section, The Linde Air Products Co., New York.

been accepted as standard—a figure undreamed of before the advent of welding. It is reported that leakage tests have actually shown an increase in the gas in the line, although no official record shows any testing division of an operating department as having credited the construction department with creating gas as a result of employing welded construction. Welding, nevertheless, has forced refinements in metering and measurements.

The more or less standard practice today has been to use

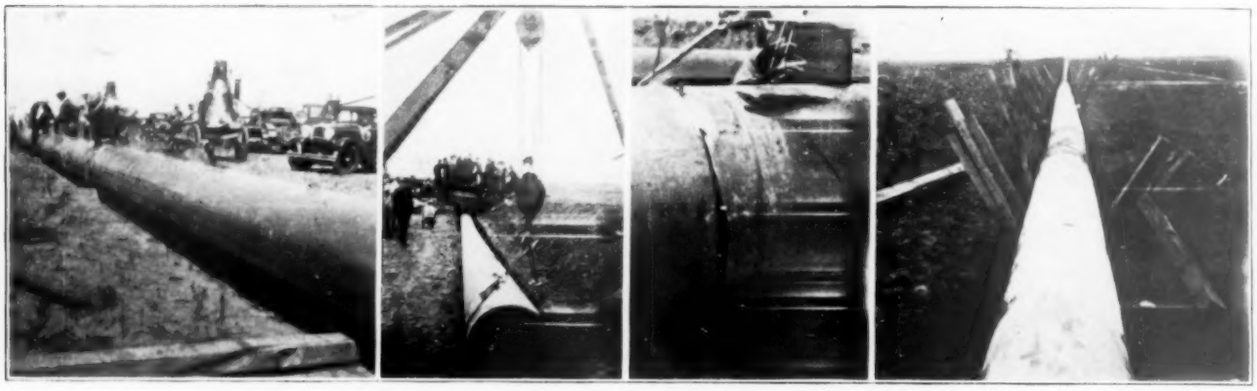


Fig. 2 (*Left to Right*). **Gang Making a Rolling Weld, Cold Bending to Fit Contour, a Pipe Liner, and a Slack Wallop.**

solid-welded construction for lines smaller than 18 in. Solid-welded construction also has been used on larger sizes, as 18 and 20 in. Above 20 in. diameter, however, the general practice has been to use composite construction.

Composite Construction Finds Favor with Large Lines

It is desirable to review some of the reasons why composite construction is used on the larger lines because the solid welding of large-diameter pipe presents and necessitates special engineering consideration and construction. Theoretically, the unit stresses set up in a large pipe as a result of temperature drop are the same as in a small line; but, due to their very nature, there probably is an unequal distribution of the contraction forces in large-diameter pipes, thus imposing higher stresses on certain elements than on others. The problem is further complicated by the introduction of differential stresses in a large line during construction. Moreover, it is exceedingly more difficult to provide adequately the slack in the line required to compensate for contraction. The laying of slack wallops, which at the best provide for only about half of the contraction requirements, imposes very high stresses—stresses so high, in fact, that failure may occur unless the welding is of the highest quality. These are only temporary and are relieved on lowering the pipe to the bottom of the trench, but they complicate the laying of the line.

In addition to the temperature stresses, there are superimposed bending stresses which from the very nature of the line cannot be minimized in the larger diameters. Smaller pipe can be easily cold-bent to fit the contour of the ground closely; but in the larger diameters this cannot be carried to such accuracy, with the result that these strains may become very excessive. Theoretically, for the same deflection the stresses are proportional to the diameter, and, although they may be negligible for small diameters, become very high as the pipe size increases. Of course, these stresses can be reduced and alleviated by changing the construction from that of a solid, continuous tube to that of a series of free-length beams, as it were, by the introduction of couplings properly placed. It is for this reason, as well as the simplification in construction, that composite construction has been more extensively used in the larger sizes.

There is need for development of more satisfactory procedures and methods in the way of bending the pipe to meet the contour and of providing for expansion-contraction, as well as need for adopting practices that will assure extremely high weld quality to withstand the strains set up on the circumferential joint in the construction and operation of large-diameter lines. These features have received careful consideration, and engineering thought and procedures have been developed which have proved satisfactory in meeting all requirements. But further thought and time are necessary to put these into general practice and to speed up the construction such as to make them universally acceptable.

One development has occurred during the year which may prove of decided importance in the future construction of large lines. It has been the generally accepted theory of engineers that the maximum length of pipe between rubber couplings should be limited to about 100 ft. in order that the leakage will be minimized at the rubber couplings. We have recently seen the establishment of a precedent in which lengths as long as 350 ft. have been solid welded, and it will be interesting to note what effect this will have under operation. Should this prove satisfactory, it will lead to the welding of practically the entire line, taking advantage of the leak-proof and economical qualities of the welded joint, yet with simplification of construction attending the use of rubber-coupled joints at long intervals.

With the transportation of gas enormous distances, economical factors have introduced and necessitated the use of extremely high pressures, which, in turn, have required special high-strength pipe. Pipe in large diameters today is being used having a carbon content of 0.30% to 0.40% and an ultimate strength higher than 80,000 lb. per sq. in., even as high as 100,000 lb. The welding industry, fortunately, has kept abreast of this development in materials; and due to the improvements in welding and the development of special welding rods, welded joints can be made as strong as the pipe.

Only "Super-Perfect" Welds Can Meet Today's Requirements

The welding of such large diameters and of pipe material of such high strength has necessitated raising the quality of the welding to such an extent that "super-perfect" welding is required to meet the construction and operating services. One outstanding development which is being followed this year to give assured high weld quality is the use of a thin backing-up liner to aid in the welding of the pipe joint. These liners are of thin material, about 1/16 to 3/32 in. thick, depending upon the pipe diameter, and about 1¼ to 1½ in. wide, which fit the inside of the pipe joint under the butt weld. The liner, with the spacers attached to it, accurately governs the spacing and permits the operator to fuse readily for the full wall thickness. In fact, with a special design of liner, it is possible to reinforce the inside of the

joint, fusing to the liner and making it an integral part of the weld. There are, of course, no protrusions or icicles, and yet it is reinforced on the inside to give a full-strength joint even without external reinforcement, which it fallaciously had been assumed compensated for weakness that often occurred at the bottom of the joint. The liner so snugly fits the inside of the wall that there is little obstruction, if any, to the flow of the transmitted fluid. On the larger diameters these have proved to be economical and desirable in obtaining the weld quality necessary.

As stated before, the oxy-acetylene-welded joint has been economical. With the development of efficient welders and the welding more on a mass-production basis, which the industry has enjoyed, the cost has decreased. The cost today in welding even the large diameters is less than the cost of welding the smaller sizes several years ago. Means of reducing the cost and speeding up the welding have been given careful consideration. Suitable progress has been made along these lines in the way of using larger flames, decreasing the angle of the vee, and keeping the weld as small as possible. Moreover, there has been a decided reduction of the depth of fusion into the sides of the vee, as the practice in the past of melting for quite a distance into the walls of the pipe, carrying a large weld, is somewhat extravagant and costly. Many of these developments place oxy-acetylene welding in a favorable position with competitive processes.

Workmanship in general has shown a decided improvement in the last few years. More and more the companies engaged in welding are closely qualifying and checking the welders; and with development of suitable portable testing machines, now available, this type of inspection has proved decidedly advantageous in increasing the quality of the workmanship. The workmanship on some of the larger lines being welded, as a result of this engineering control, is of a quality unbelievable two years ago. In fact, a study of their test results shows that every joint is nearly as perfect as the pipe.

Before concluding, a few words should be said of a new field for oxy-acetylene pipe-line welding that offers tremendous possibilities, namely that of gasoline lines.

Gasoline Transportation Offers New Field for Welded Lines

The apparent success obtained by the Standard Oil Co. of New Jersey in converting their oil line carrying oil eastward to the Atlantic Coast into a gasoline line carrying gasoline westward, has led to some outstanding developments in this field. The year 1930 has witnessed the beginning of the construction of three very long gasoline lines—one, the Sun Oil, running from Philadelphia to Pittsburgh, Cleveland and other cities in Ohio; second, the Phillips Petroleum line from Texas to Kansas City and St. Louis; and the Great Lakes pipe line of the Continental and Barnsdall companies, a 1,300-mile line from Oklahoma refineries to Chicago and the Great Lakes region. All these lines are oxy-acetylene welded. The engineering features in their construction and operation offer no special problem; and with the proving of the economical factors connected with their use, it is anticipated that a new large field of pipe-line construction will be opened to carry gasoline to various parts of the country from the refineries of the various companies. Some of these, no doubt, as in the case of oil transportation, may become large public carrier systems. As the lines are small and particularly adapable to oxy-acetylene construction, requiring the adaptability, versatility and reliability characteristic of this process, a promising future is opened up for the use of oxy-acetylene welding in this new field.

ELECTRICAL ENGINEERS TO HEAR PAPERS ON ARC AND RESISTANCE WELDING

An electric-welding session is scheduled for the annual convention of the American Institute of Electrical Engineers, to be held in New York City, January 26th to 30th. The program of welding papers will be presented on Thursday afternoon, January 29th, and will be as follows: "Some Experiments with Arcs Between Metal Electrodes," by G. M. Shrum and H. G. Wiest, Jr.; "An Improved Arc-Welding Generator," by J. H. Blankenbuehler; "The Neutralized Welder and Its Applications," by F. Creedy; "A System for Direct-Current Arc Welding," by S. R. Bergman; "Resistance Welding of Motor Frames," by Malcolm Thompson; and "Electric Resistance Brazing," by Samuel Martin, Jr.

MODERN TOW BOAT IS ARC WELDED

The tow boat shown in the accompanying photograph was built by the Superior Steel Tank Co., of Kansas City, Mo., for shifting barges and handling general river traffic. This boat was built for the Massman Construction Co. of Kansas City. Its hull is fabricated completely by the electric-arc-welding process.

This new tow boat is 50 ft. long and 16 ft. 8 in. wide. The hull of the boat is constructed of ¼-in. plate, arc welded

50-Ft. Tow Boat Welded from ¼-In. Plate.

together with a butt joint. Butt straps are arc welded over the joint the full length of the seam, thus making the hull absolutely water-tight. The hull is reinforced by 6-in., 30-lb. H-sections arc welded to the bottom. There are approximately 4,500 lineal feet of welding on the hull of this boat, the current for which was furnished by "Stable Arc" welders, manufactured by The Lincoln Electric Co., Cleveland, Ohio.

Arc welding is being used quite generally in present-day ship construction, because it permits a strong and rigid design which is absolutely water-tight.

"BARE-WIRE ELECTRODES" ARE NOT BARE

By C. J. Holslag
Chief Engineer, Electric Arc Cutting & Welding Co.

THE arc-welding industry is now a little over twenty-one years old and should begin to know the facts of life. It is about time that everybody in the business understood there is no Santa Claus. So-called bare wire is in reality coated or it wouldn't operate in the arc. If any one doubts this statement, let him make the tests that I made in 1912 when I cleaned some wire of rusty spots and found that it lost its welding properties. In other words, if the dull coating, or skin, or dirt, caused by drawing is removed by cleaning by a mechanical process or by pickling, the welding properties of the wire are lost; and, vice versa, if a wire that splashes and blobs is coated, it comes back into the fold nicely.

It was just previous to the World War that the European type and the Scandinavian type of covered electrode was introduced into this country. Also, at practically this same time the American type of thinly flux-coated electrode was introduced to the American welding trade, consisting then only of hide-bound, hard-boiled railroad men who were used to bare wire. Any innovation was treated with scorn.

It was a good many years before it was generally known why some bare wire would weld well, whereas other bare wire would blow around and not flow evenly. The writer made the discovery that it was the coating, even where non-perceivable, which caused this phenomenon of good flowing.

It was only a short step to take from this discovery to the thinly covered flux-coated electrode, such as is now popular in this country and Canada also.

In arc welding, cleanliness is ahead of godliness, so incorporated in this flux coating are agents for cleansing. That action, combined with the increased speed (the definite reason for which will be explained later) and the uninterruptedness of the action, made this type of electrode more and more popular, until now it is accepted as standard.

For manual welding, there are a few who still cling to the so-called bare wire, but for automatic welding the flux-coated electrode is used almost exclusively.

Some of the practical and scientific reasons for this growth in the use of covered electrodes are as follows:

It is a well-known fact that high temperatures are invariably favorable to a chemical reaction. Consequently the temperature generated by the electric arc, which will melt refractory metals with ease in an instant, and is the highest temperature that can be produced, would naturally greatly encourage any tendency toward a chemical reaction. The first reaction is the universal chemical reaction—oxidation—and this will occur readily if the melting process takes place in air or anywhere in the presence of oxygen. There are many other chemical and physical changes due to the arc, such as the formation of compounds of carbon and nitrogen, furthered by the high temperature of the arc; these are undesirable in the completed arc deposit. The problem, therefore, that confronts the welding operation, or any process in which the melting of metal is concerned, is to prevent as far as possible the partial combination of the molten metal with oxygen and nitrogen; in other words, to avoid the formation of metallic oxides and nitrides. These compounds are, in general, very detrimental to the success of welding or casting, because they form inert, impervious and brittle masses that are liable to become entrapped in the weld, creating weak and imperfect sections. Therefore, any agent which will act to prevent their formation in the melting and welding of metal is highly desirable. The greatest of these aids is found in the use of various kinds of fluxes.

The Slag-Coated Electrode

The problem is, primarily, to shield the molten metal as far as possible from contact with the air, and then to dispose of whatever oxides or nitrides have unavoidably formed. If the proper fluxes are chosen, both these conditions may be thoroughly realized. If it is possible to surround the active weld with an inert mass that will melt at the temperature of the arc but will not combine with the air, the molten metal will then be prevented from coming in contact with the air, and oxidation will be greatly reduced. This is actually the condition realized in the use of the slag-coated electrode. This special electrode has a coating of such thickness and quantity as to melt at a steady rate with the melting of the electrode tip, and to form an evelope at all times about the arc and the molten puddle.

A coating such as this may be of slag, asbestos, or various silicates; in short, any material that may be used as a coating and will not combine with oxygen. The drawback of this type of coating is that the slag is liable to become entrapped in the weld; and in protecting the deposit from microscopic impurities, actual deposits of slag may be found in the weld. This type of coating makes "arc welding" easy, but greater care must be taken to prevent slag inclusion. Also, chipping between layers and in retorting is absolutely necessary. Besides this type of dead, inert coating, the electrode may be coated with fluxes that are chemically active in a favorable way and which do not deposit a slag tenacious or thick enough to require chipping.

The quality obtainable with the use of the flux-coated electrodes makes them economical. With the flux-coated electrode it is possible to duplicate all the physical properties of cast steel—ductility, elongation, tensile strength, alternating stress, etc.

In August 1919, the Wirt-Jones tests showed that the properties of ductility and elongation were increased by fluxed electrodes and at no sacrifice to strength, in each case the test piece breaking outside the weld.

Cast-Iron Welding

In cast-iron welding, the use of flux is almost indispensable; in fact, most of the improvements in cast-iron welding have been due to the use of fluxed electrodes. This type of flux either unites with the excess of carbon in the cast iron, or tends to keep the hard carbon-iron compounds from forming. It is composed of a compound rich in carbon, together with lime or other carboniferous compound which becomes active under the heat of the arc and resupplies the free carbon, which tends to keep the weld soft. In addition to this, the flux may contain nickel, silicon, manganese, or other compounds which prevent oxidation, tend to keep the weld molten, and bring out other desirable results. The flux-coated steel electrode is of great assistance in all studding work and in any other work of a kind in which special conditions have to be met. A specially developed flux makes possible the use of an electrode actually made of cast iron.

The flux coating not only aids in many special ways, but actually lowers the cost of the weld by its capabilities of greater speed of deposition and surer production of consistently desirable results. Of course, a skilled operator with a bare wire electrode may hold a close arc so as to cut the oxidation down as much as possible, and produce passable results; but for general use in the hands of the average operator, the fluxed electrode is best, not only because it is capable of greatly improving the weld, but because it is easier to run, and allows the operator's attention to be directed at the work instead of on the electrode. With the use of bare wire, much time is inevitably wasted in chipping, sand-blasting and brushing to remove the excess oxide.

Flux-coated wire is speedier on three counts. First, it requires less brushing, preparation and interrupting of the actual welding operation; second, the voltage across the fluxed arc is higher than across the bare rod, and the amount of work done is directly proportional to the amount of energy liberated at the arc. Hence, for the same current, the arc is proportionately faster, due to the higher voltage; and there is less spatter and unnecessary oxidation with the fluxed electrode because the arc is concentrated or focused like a stream coming from a nozzle. Also since fluxed wires do not deposit a slag, time is saved in chipping. Even a bare-wire deposit has to be chipped or bobbed to remove slag deposit.

Of course, flux can never overcome the bad effect of poor base metal any more than sauce will make a poor steak good; but with good base metal a flux covering will greatly improve all welding and make some developments possible.

For many years the advocates of direct-current welding took the position that coated electrodes were for alternating-current welding and "bare" wire for direct-current welding. Experience has certainly not justified this conclusion, and more recently the direct-current people have tended toward the recognition of the coated electrode as an improvement in arc welding. However, in the writer's opinion it is still true that alternating current is the best to use with covered electrodes, that it is faster and cheaper, that it leaves a less tenacious slag, and that there is less liability of leaving gas pockets and slag inclusions on account of the puddling action of the alternating current. The writer does not hesitate to stand back of this opinion, on account of having pioneered the applications of both flux-covered electrodes and alternating-current arc welding in this country.

Welded Compromise Rail Joints

The Joining of the Standard Rail to the Trilby Rail by Means of Welding Results in a Low-Cost Joint Adaptable to Street Crossings

A METHOD for making compromise rail joints by oxy-acetylene welding has been developed and adopted by The Pacific Electric Railway of Los Angeles, Calif. The accompanying photographs fully illustrate the application of the welding procedure in this interesting development in rail welding.

Fig. 1 shows end views of a standard rail and the Trilby rail, the latter being used where pavement extends across the tracks, having a lip to extend over the edge of the pavement to prevent cracking and breaking of the pavement. These compromise rail joints are used principally at railway street crossings where city ordinances require that heavier steel be used than is usual for the ordinary regular track service.

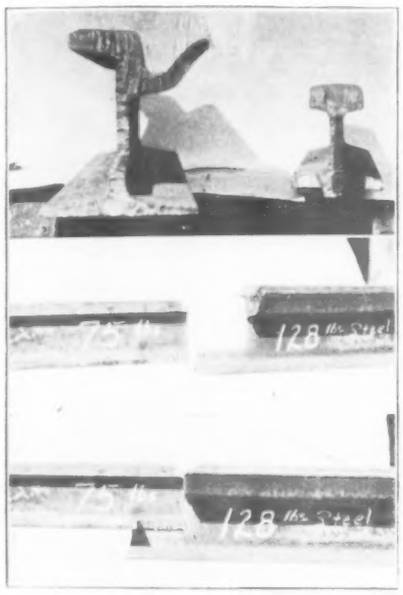


Fig. 1 (*Top*)—Views of Cut Ends of Rails Ready for Welding. Fig. 2 (*Center*)—Another View of Rails Before Welding. Fig. 3 (*Bottom*)—Ends in Place.

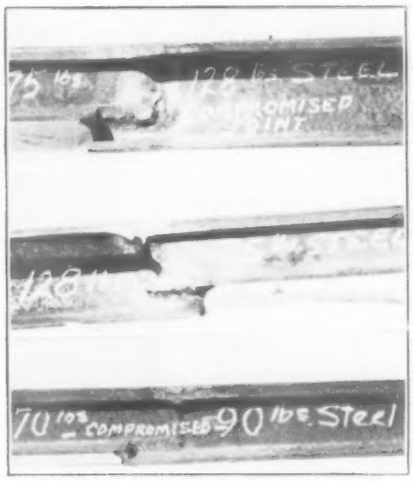


Fig 4 (*Top*)—Outside View of Compromise Joint After Welding. Fig. 5 (*Center*)—Inside View of the Completed Joint. Fig. 6 (*Bottom*)—Welded Compromise Joint Between a 70-Lb. and a 90-Lb. Rail.

Fig. 7 (*Top*)—Close-Up Inside View of a Compromise Joint Between a 70-Lb. and a 128-Lb. Rail, Showing Clearly the Welded Joint Between the Webs of Both Rails. The Web of the Standard Rail Rests on the Projecting Web of the Larger Rail, Adding Strength and Rigidity to the Joint. Fig. 8 (*Bottom*)—A Similar Joint Between a 60-Lb. and a 128-Lb. Rail.

A 75-lb. standard rail and a 128-lb. rail cut and prepared for the new method of welding for a compromise joint, are shown in Fig. 2. The flange of the smaller rail is cut out, as is also the top section of the larger rail, to allow the two rails to fit together with the top, or ball, of both rails on a level. Fig. 3 shows the two rails placed together ready for the welding operation, while Fig. 4 shows the outside view of the finished job, and Fig. 5 the inside view of the joint completed.

Fig. 6 is a welded compromise joint between a 70-lb. and a 90-lb. rail; Fig. 7 is a compromise joint of a 70-lb. and a 128-lb. rail; while Fig. 8 is another between a 60-lb. and a 128-lb. rail. Figs. 9 and 10 show outside and inside views of a welded joint by straight butt welding on two ordinary standard rails of 128-lb. size. While the company has not used this joint under traffic, they contemplate testing it and are confident that it will prove a success.

Advantages

The chief advantage of this new method of making compromise rail joints is the saving in cost. It is estimated that the average saving of the new welded joint is about one-half, while the average cost of the new compromise welded joint (cost figured against the regular standard compromise joint) is about one-third, which does not include the saving in stocking of the various sizes of compromise joints, parts, etc.

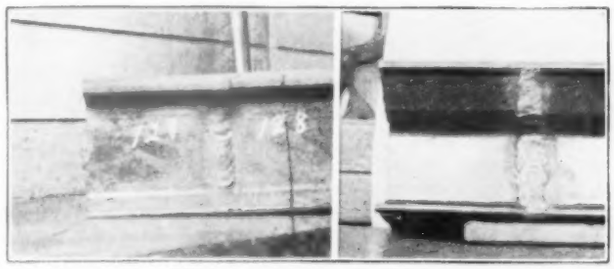
Other advantages which add to the value and practicability of this new method are:

First, it eliminates vibration and cuts out all maintenance costs.

Second, an entire joint and bond are eliminated.

Third, the joint can be welded either by removing the rails, or under traffic without removing the rails.

The Pacific Electric Railway has been using this method of rail-joint compromising for almost two years without a single failure. They point out, however, that it has been only through the work of welders well experienced and familiar with this work that they have maintained this record.



Figs. 9 and 10. Inside and Outside Views of Welded Joint Made by Straight Butt Welding on Two 128-Lb. Standard Rails.

Credit for the development and perfection of this new method of rail-joint welding is due Paul W. Turri, a welder employe of the Pacific Electric Co., who is kept on duty in

tne shops of the company at Washington St. and Long Beach Ave., Los Angeles.

As nearly as can be ascertained, the approximate average cost of the welding of one of the joints is $6.00, which covers the labor of operator and one helper, oxygen and acetylene, and filler rod. No account has been kept which would show the amount of labor, gas, etc., used in preparing the weld. Fifteen minutes is usually required for cutting and preparing the rails for welding. No grinding is done before welding is started. Just a hammer and chisel are run over the work to remove the slag. No. 6 C. M. Oxweld rod is used for the welding.

In the welding of an average joint, about 60 cu. ft. of acetylene and about 70 cu. ft. of oxygen and 2 to 3 lb. of rod are consumed, and about 1¼ hours of time for one welder and one helper is required.

Procedure

The weld is started at the top or ball of the rail, filling completely across the entire ball. Then a new start is made from the bottom or extreme edge of the flange, working upward to the ball, the same procedure being followed on each side. The top of the ball is hammered down smooth while hot immediately after the weld is finished.

The company is using but one operator on a joint at present. However, it is pointed out that a considerable saving in time and gas could be made by the use of two operators. Smaller tips could be used, and the saving in gas would be quite an item. This work being entirely different from the average welding job, it would be wise to see that both operators understood this particular kind of undertaking thoroughly before proceeding.

Joints are welded either by spiking down to ties right in the track or by placing on blocks at the side of the track and spiking to ties to prevent warping during the welding process. The former method is the more practicable, and it can usually be done with the removal of but one or two ties, thus saving handling of the rails.

No grinding is needed after the weld is completed. The top is finished by merely heating to a cherry red and hammering out smooth.

One operator and one helper handle the welding, preparation, and completion of the job when done in the track. When the joints are placed on blocks out of the track, two extra men would be required to handle the rails. In the estimated cost of the welded joint as mentioned above, no estimate was taken into account for the use of labor other than one operator and his helper.

WELDING CONFERENCE IN CLEVELAND NEXT MONTH

The Case School of Applied Science, Cleveland, Ohio, and the Cleveland Engineering Society are planning a joint conference on welding to be held on February 19th and 20th at the Case School of Applied Science. The first morning of the conference will be devoted to registration and to demonstrations of the various processes. The afternoon of the first day will be devoted to papers discussing the different welding methods. In the evening, F. T. Llewellyn of the United States Steel Corp. will present a paper entitled "General Outline of Welding Processes."

The second day of the conference will be devoted primarily to problems such as design, testing welds, training welders, etc. Arrangements are being made with some of the leading authorities in the welding industry to present papers on these special topics. Some time will also be allowed on the second day for demonstrating. It is expected that there will be a large attendance. Arrangements already made for the program are such as to assure the time being well spent. Those who desire to have programs mailed to them before the day of the conference can probably arrange for this by writing to Fred L. Plummer, of the Case School of Applied Science, Cleveland, Ohio.

ELECTRIC WELDING FIELD JOINTS ON PANHANDLE-CHICAGO 24-IN. GAS LINE

Work is rapidly going forward on the electric-welded sections of the 24-in. gas line being constructed from the Texas Panhandle to Chicago. The line is being built by the Continental Construction Corp. of Kansas City, Mo. The total length of the line when completed will be approximately 1,000 miles. The pipe is being welded into two- or three-joint sections and then coupled. To date, 643 miles of the line has been awarded, and of this amount 333 miles is being electric welded. The pipe being used is fabricated in lengths of 30 to 40 ft., and the joint is plain end with inserted ring.

Fig. 1. Showing an Operator at Work on a Section as It Is Turned by His Helper.

The arc-welded joints are made as shown in Fig. 1. Pipe is lined up on rollers. After tacking, the weld is put on in two beads. The electric welding has been sub-contracted to the Welding Engineering Co., of Bartlesville, Okla., who utilized the "Fleetweld" process developed by The Lincoln Electric Co., of Cleveland, Ohio, in welding the joint. Welds produced by this process are made with a shielded arc which prevents the inclusion of oxides and nitrides in the weld metal. This elimination of impurities gives welds so produced a tensile strength of 10 to 20 thousand pounds greater than mild rolled steel, and an elongation of 20% to 30% in 2 in. These welds are also said to be produced more rapidly than with the ordinary arc-welding process. On this new line only 25 minutes are required to complete a joint on pipe with wall thicknesses of $\frac{5}{16}$ and $\frac{9}{32}$ in. Thirty-six Lincoln machines are being used on this line.

Fig. 2. A Section of the Continental Pipe Line in Iowa.

Fig. 2 shows a section of the line being constructed in Iowa. At this point the sections are composed of three pipe lengths between each coupling. The general contractor on this part of the line is The Henry L. Lemons, Inc. Other general contractors utilizing electric welding on the line are the Sheehan Pipe Line Construction Co. and Bechtel Kaiser, Ltd. These companies are already at work on their sections of the line.

Hints for the Welder

WHEN YOU FIND a new way to do a hard job, or finish a particularly interesting weld, can you describe how the work was done? . . . . . Have you learned some little stunt every welder ought to know? . . . . . Write to us about these things . . . . . This department helps you welders to help each other. Write up your ideas any old way and just make rough pencil sketches . . . . We'll fix them up for publication.

SIMPLE TEST HEAD FOR PIPE

By J. C. Phillips

A simple device for sealing the end of a pipe to allow a pressure test to be made is shown in the illustrations. Fig. 1 shows one of these test heads mounted on the end of a drip pipe, and also another and similar head detached from the pipe. In Fig. 2 is shown the individual parts that make up this test head.

The test head is held in place on the end of the pipe by means of set screws, as shown. It will be noticed that the

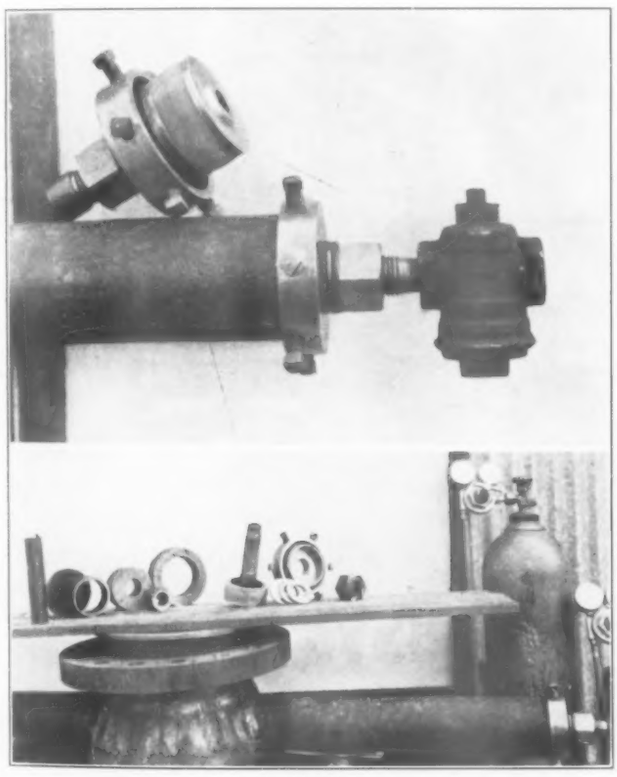


Fig. 1 (*Top View*). Shows Two Test Heads, One Being Installed in the End of a Pipe. These Are Made from the Parts Shown in Fig. 2 (*Lower View*).

part of the head which enters the pipe consists of a flanged sleeve carrying a rubber gasket. This sleeve is fastened to the end of a threaded bolt which carries a hexagonal nut for tightening up the assembly and the other end of which is threaded for a standard valve.

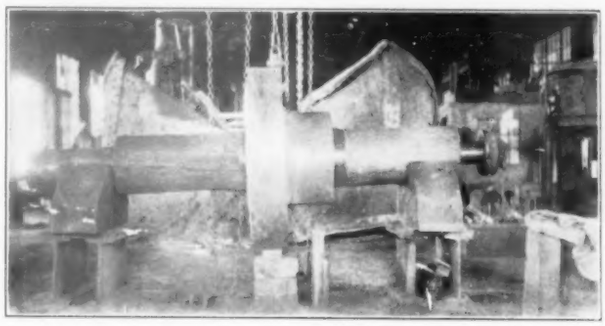
After the test head is mounted in place by tightening the set screws in the face cap, the hexagonal nut is screwed up against a ball race on the face cap. Further turning of the nut exerts a pressure against the rubber gasket, caused by bringing closer together the flanges on each side of the gasket. Thus the gasket bellies out and seals the inside of the pipe.

BUILDING UP A CRUSHER-ROLL SHAFT

By Fred A. Cosgro

The shaft of the 5-ton crusher roll shown in the illustration was built up by arc welding, employing the puddling method for the first layers of weld metal, and using a trammel to determine the effect of contraction strains on alignment as the welding progresses.

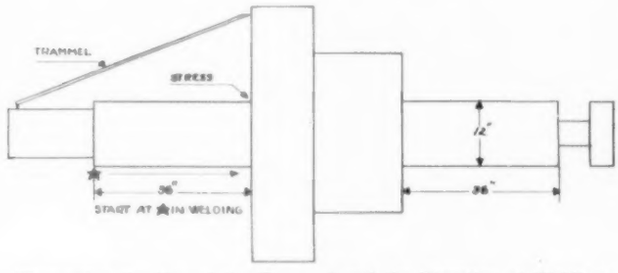
On a job of this kind, a ¼-in. vanadium or nickel steel



View of 5-Ton Crusher Roll After the Shaft Was Built Up.

electrode is used, with the electrode run amply hot. Use one rod in the holder and one in the hand. Build up the shaft lengthwise, using the puddling method on the first half of the weld metal, then remove the oxides with an air hammer and bobbing tool.

Notice the smoke while welding. If smoke shows up behind the electrode, you are making a "smoky weld." The smoke should always be in front, unless you are working



Illustrating the Use of the Trammel and the Direction of Welding.

around drafts, in which case use only the rod in the holder and bead weld the last half of the metal deposit.

Check once in a while with the trammel as a guide. To use the trammel, center punch in four equal parts the smooth end of the shaft near its extreme end; then by means of the trammel compare the distances from each mark to the near edge of the crusher roll, as the diagram shows.

A hammer and chisel should be used ever so often to see if any hard spots develop. I never reverse the polarity, as I

find that the hard spots always result from having two-thirds of the heat in the rod instead of in the roll, where it is needed. Work in the beads well, and don't try to cover too much space with them; then you will have a surface free from black spots in the weld.

When the job is completed, I heat the roll to a cherry red to relieve stresses in the shaft. The stresses I find to be concentrated at the point indicated by the arrow. I have seen roll shafts snap off at this point. Whether oxy-acetylene or the electric arc be used, the welding should start at the end of the shaft and proceed inward, which increases the intensity of the contraction stresses at the end and relieves the stresses in the middle of the shaft.

These shafts carry a live load of 45,000 lb. per sq. in. One such job as this pays for the cost of an arc-welding machine in the amount saved.

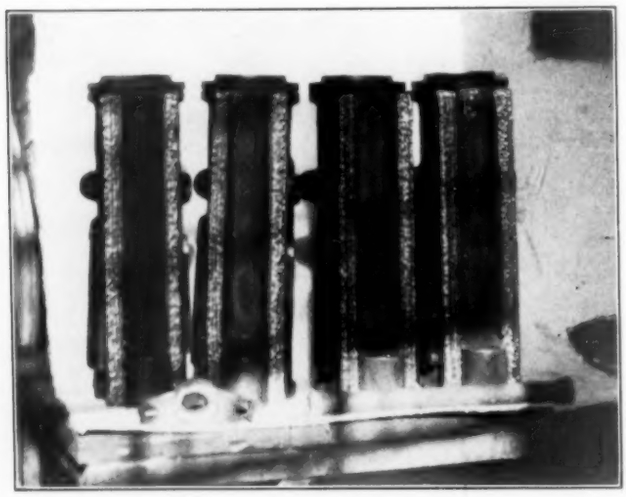
In building up small armature shafts, it is preferable to mount them so they can be easily rotated, and then deposit the weld metal around the circumference instead of lengthwise along the shaft. This method allows some of the impurities to run off, more metal can be added, and it requires less work.

SALVAGING ROCK-DRILLING MACHINES

By Mike Bokros

At the Walker mine at Spring Garden, Calif., is some of the hardest drilling rock to be found anywhere. The slides of rock-drilling machines used at this mine are so worn after about 18 months' use as to render the machines useless, although the cylinder is still good for many months of wear. About 14 months ago I built up for the first time the worn slides of some of these machines, which heretofore it had been the practice to scrap, and the welded machines have been very successful in service. One machine recently had its slides built up for the second time, after having been in use just 12 months.

I use the electric-arc method of welding, employing Roebling electrodes. It is necessary during the welding operation



Slides of Rock-Drilling Machines Built Up by Welding.

to keep the machine cool at all times to prevent warping of the cylinder. The cylinders are ground with great precision by the manufacturer, and a little overheating will ruin them. The cylinder will not be harmed if it is kept cool enough not to burn one's hand.

In order to save time, I find it best to get four or five of these machines to weld on at one time; then when one is cooling off another can be worked on. If I can get only one or two of them, I lay the machines aside when they become warm and work on something else.

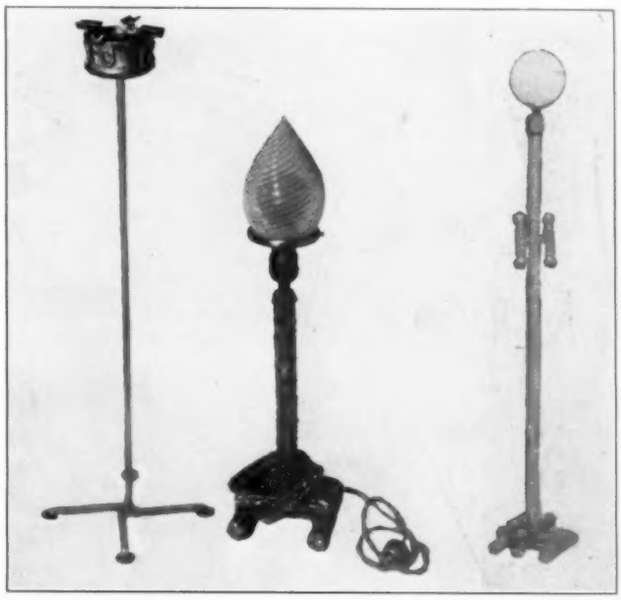
In order to distribute the welding heat more evenly over the machine, I lay the bead lengthwise on the slides. A ¾-in. slide requires about five beads. After welding, the slides are machined and the cylinder is then ready for use again. The illustration shows four machines built up and ready for machining.

I have also been building up such minor parts as crossheads, spreaders, and frontheads with satisfactory results.

WELDED SCRAP MAKES USEFUL ARTICLES

The smoking stand and lamps shown in the illustrations are arc welded, and they suggest many other useful things that the welder might make for the home or office. These articles are out of the ordinary in design, yet pleasing to the eye. Where the material used is scrap and can be obtained for little or nothing, it might be possible to build up a lucrative business in this line of work. When the welder finds spare moments on his hands, he can turn his idle time to advantage in welding up such articles for his own use or for his friends, or possibly for sale.

The welding-shop owner or manufacturer who uses welding in production might have similar articles made up for



After a Little Practice in Holding the Electrode, Almost Anyone Can Make a Smoking Stand and Lamps Such as These.

giving to his customers or prospects in developing good will and new customers. Articles made by idle workers out of scrap cost practically nothing except the small cost for current or gas.

The smoking stand shown was made for a contractor out of scrap left from the erection of a new building at a mid-western university. Being one of the contractors on this job, he holds this article in much higher value than its mere utilitarian worth, because of the sentiment connected with it. Moreover, it is a neat stand which would fit well with the furniture in most any home or office. The stem and base are made of concrete-reinforcing bar, each arm of the base resting on a small disc, to which it is welded at the end. The tray is a threaded sleeve used commercially for protecting the threaded end of a pipe. The lower end of this sleeve is closed with a welded disc, which in turn is welded to the stem. Four short pieces of half-inch angles are tack welded to the rim of the tray for holding lit cigarettes. After welding, the entire piece is given a coat of paint. Metallic paint is particularly pleasing on welded articles of this kind.

The lamps illustrated are made of metal conduit, long pieces being used for the stems, and short pieces in the bases with the ends closed by welding on discs. A decorative effect

s given the conduit by depositing weld beads to form patterns. In the case of the table lamp, these beads cause the stem to resemble a huge candle with molten wax running down the sides. A small horseshoe is welded to the base of the small lamp, and decorated with weld beads. The laying of weld beads for decorative purposes can be done by almost any novice, no training being required.

The smoking stand and both lamps shown were welded in the shop of F. Lemieux, at 410 S. Laflin St., Chicago, Ill., and considerable of the welding was done by a student just starting to learn the welding trade.

GARBAGE DISPOSAL SIMPLIFIED BY WELDED INCINERATOR

The welding shop is not usually considered as a guardian of health. Yet in at least one instance this has proved to be the case. The welding shop of a Southwestern pipe-line company decided to utilize the known advantages of welding (airtightness, reliability, strength) in assisting in garbage disposal.

The illustration shows an all-welded incinerator. Garbage can be safely stored in here until such time as it is desired to

Leaky Seams Are Unknown in This Welded Incinerator.

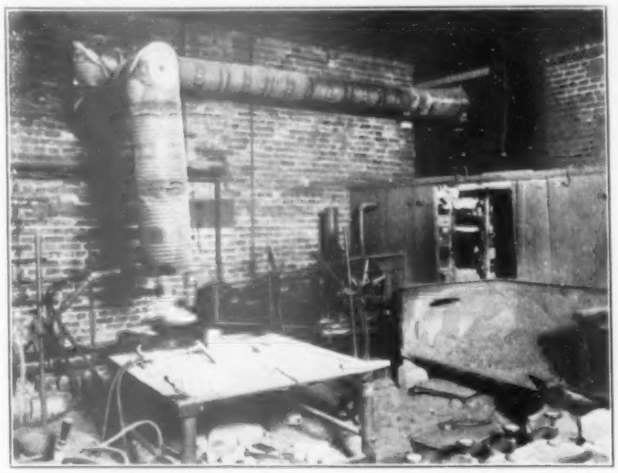
burn it. With welded seams the possibility of garbage odors escaping from the incinerator proper is minimized. In addition, the sturdy construction makes it possible to submit this incinerator to rough treatment without injury. Once more the welding torch renders a service to the community, this time by simplifying the problem of garbage disposal.

VENTILATOR MADE OF CARBIDE DRUMS

Like old safety-razor blades, empty carbide drums look so potentially useful that one hates to throw them away. To the already lengthy list of uses for carbide drums, another was recently added by an ingenious Southern welding organization.

Needing about 30 ft. or so of ventilator or exhaust piping in the welding shop, and having many empty carbide drums lying about, the owners conceived the idea of using the drums for piping. This they did, with the result shown in the illustration.

Their first step in making the pipe was to cut the ends off the drums, thus producing perfect corrugated steel tubes.



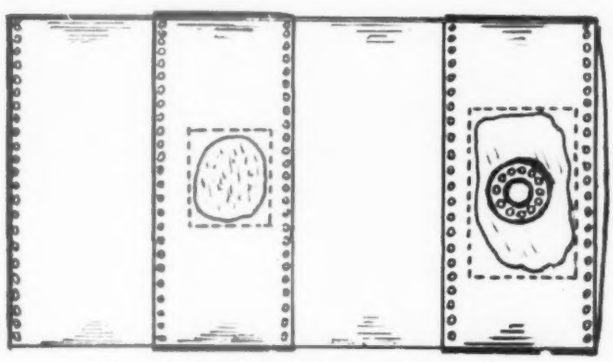
Bronze-Welded Carbide Drums Form This Novel Ventilator.

These were then bronze-welded together into a solid length of pipe. A suction fan at the outside end creates the draft. Two swivel joints make the end over the welding table easily adjustable. The owners report that the ventilator works perfectly and keeps the shop free from smoke and fumes.

CUTTING TORCH MAKES QUICK WORK OF BOILER-REPAIR JOB

By R. C. Leibe

The experience of two industrial plants in cutting blisters, or bags, out of fire-tube boilers offers an interesting comparison between the two methods used. It happened that these two plants, which were located in the same county, had similar trouble with their boilers. Because of the accumulation of mud and scale on the inside of the bottom sheet, the sheet at this point became overheated and the steam



Underside of Boiler, Showing Location of Patches.

pressure inside the boiler pushed the sheet out, balloon fashion, causing a bag or bulge. A condition like this is liable to result in considerable damage if it is not discovered before the heated and stretched sheet becomes so thin as to burst.

In both the plants mentioned, the bulged-out sheets on the bottom of the boilers were discovered when the rivet holes began leaking. To make the necessary repairs, the bulged

sections were cut out and patch plates used to cover the holes thus made.

In one case, that of a 150-hp. boiler, the repair was quickly made by using the cutting torch for removing the damaged boiler plate, which covered an area of about 3x4 ft. near the blow-off pipe in the rear of the boiler. The job took less than half an hour, and but little expense was entailed in the cutting.

In the case of the other plant, the owners and a machinist who had a prejudice against gas cutting and welding decided that the cutting torch would greatly injure the steel of the boiler sheet and cause trouble. Therefore, they employed six men as helpers and drilled hundreds of ½-in. holes through the ½-in. steel sheet to resemble a check and stub, which consumed three days cutting out the 4x4-ft. damaged section. It happend that this damaged part ran into the end of the boiler, making it necessary to cut out some thirty large 1-in. rivets, which was done with a cold-cutter tool and sledge hammer in a tight place with strokes over the men's heads, and thus added two more days to the job.

The putting of patches on the boilers amounted to about the same time in both cases. Thus, one man with a cutting torch did in one-half hour the same work that it took six helpers and one machinist working five days to perform, with not the slightest damage to the boiler plate.

The welding and cutting torch has proved itself of great value in boiler workk of all kinds. It has changed boiler repairing from a difficult work to an easy one. The diagram represents the underside of the 150-hp. boiler on which the cutting torch was used to remove bulges in the sheets, and the dotted lines show the location of the two squares cut out by this method. The large bulge was 5 in. deep in the center.

COAST-TO-COAST TRIP REVEALS OPTIMISM IN WELDING INDUSTRY

A letter recently received from E. L. Mathy, Vice President of the Victor Welding Equipment Co., San Francisco, right after he had completed a 11,000-mile trip over the United States, suggests in several ways that the hopeful expectations of manufacturers in the welding industry for future business are well founded. Mr. Mathy has made the transcontinental trip by railroad a good many times, but his most recent trip was made almost entirely by automobile because he thought that such a trip would furnish a better opportunity to gain a conception of business conditions and requirements within the territories of individual Victor distributors. It was also deemed advisable to make personal calls upon many of the widely separated and almost isolated welding institutions.

Such a trip gives one a definite understanding of the distance involved in a complete tour of the United States and also a good conception of local atmospheres, which it is almost impossible to get when covering the ground with railroad trains and taxicabs. In fact, Mr. Mathy mentions as one of the advantages of the trip that it enabled him to visualize how the oxy-acetylene industry may have overemphasized the sale possibilities in the centers of large population and under-estimated the need of developing the existing sales fields in the vast areas where definite business expansion is possible. Furthermore, he had many opportunities to visit other manufacturers in the same industry and reports that many of them are recognizing the extent of potential undeveloped markets. They are actually doing things about these markets instead of just thinking about them. In fact, Mr. Mathy makes special mention of the optimistic attitude displayed by manufacturers in our industry. They seem to realize, he says, that "any national effort to lower manufacturing and maintenance costs is bound to extend welding and cutting into even wider fields."

These observations are based on a trip which lead through the Sierra Nevadas into Salt Lake City; then to Denver through Wyoming to Kansas City; straight east to Pittsburgh, to New York; back to Washington; through Virginia, Tennessee and Mississippi to New Orleans. All the important points in Texas were covered on the trip, a part of which had to be made by airplane on account of the road conditions in some parts of that state. From Texas back to California the route was through New Mexico and Arizona.

This trip, concludes Mr. Mathy, "causes me to be more than ever assured of the vast potentialities in the welding and cutting industry." Such a conclusion is certainly of great interest to the manufacturers in the industry, since it is based on such a long trip which included the areas where these processes have their greatest possibilities of future expansion.

LINDE EXPANDS SERVICE FACILITIES

All those units of the Union Carbide & Carbon Corp. whose products are used in the main for oxy-acetylene welding and cutting are now marketing their products through the Linde Air Products Co., it is announced. It is now possible, therefore, to secure Linde Oxygen, Union Carbide, Prest-O-Lite Dissolved Acetylene, and Oxweld, Prest-O-Weld and Purox apparatus and supplies through this one company.

This new arrangement has been made for the added convenience and economy of the users of these products. No changes have been made in telephone numbers or addresses of the distributing stations from which these products have been secured in the past, and customers can continue to place their orders at these points.

FINDS BUYERS ACTIVE IN MEXICO

A letter received from J. M. Mathews, of the Harris Calorific Co., comments on an interesting eight weeks' trip to the states of Indiana, Kentucky, Tennessee, Alabama, Georgia, Texas, Oklahoma, Kansas, Missouri, and the Republic of Mexico. In the latter country the places visited included Neuvo Laredo, Monterey, Mexico City, Pueblo, and San Luis Potosi.

Mr. Mathews remarks concerning the appointment of distributors in Mexico City and good orders for apparatus received from such large institutions as National Railways of Mexico, two of the largest airplane factories, the Anglo-Mexican Petroleum Co., and the J. F. Martin Co. Orders for over one hundred Harris "Red Head" generators were booked. "All things considered," says Mr. Mathews, "we cannot complain of conditions encountered anywhere."

C. I. G. OPENS APPARATUS REPAIR BUREAU IN KNOXVILLE

Compressed Industrial Gases, Inc., Chicago, manufacturers of oxygen, hydrogen and acetylene, recently announced the opening of a new apparatus repair bureau at Knoxville, Tenn. This new bureau is installed for the purpose of repairing all types of oxy-acetylene equipment, including regulators, torches and generators. It is in charge of specially trained equipment repairmen. It is said that a considerable amount of new machinery and equipment has been installed in order to make this a complete and high-grade repair station.

VICTOR EXHIBIT AT WESTERN METAL SHOW

The Victor Welding Equipment Co., of San Francisco, Calif., will have a particularly interesting booth at the Western Metal & Machinery Exposition, which is to be held in the Civic Auditorium, San Francisco, Calif., from February 16th to 20th.

Not only will there be displayed a complete line of Victor welding and cutting torches, pressure regulators, cylinder

manifolds, cylinder trucks, acetylene-gas generators, and welding supplies, but the very latest Victor developments will be demonstrated. While there have been no changes made in any of the standard Victor torches or regulators, a great many new devices for special cutting, brazing and welding operations have been added to the Victor line.

The Victor exhibit occupies booth No. L-27, a location flanked to the left and to the right by particularly interesting exhibits of two of the largest oil companies. The Victor booth will be attended, during every hour of the day, by a staff of Victor factory engineers.

691 ELEVATED-TANK DESIGNS TO BE SUBMITTED IN COMPETITION

The elevated-steel-tank competition being sponsored by the Chicago Bridge & Iron Works, upon which the entries closed December 1st, has created considerable interest, judging by the number of applicants. Six hundred and ninety-one architects, engineers and draftsmen registered their names with Albert M. Saxe, the professional adviser, and are now at work on their designs, which are due on March 1, 1931. The contestants are residents of sixteen countries, Germany ranking next to the United States in number of entries with forty. Announcement of the awards of eight prizes totaling $4,000 will be made soon after the close of the contest.

ANNOUNCES 24-HOUR REPAIR SERVICE

The Harris Sales Co., at 1801 S. 68th St., Philadelphia, Pa., have announced to their customers that they can be reached day or night, including Sundays and holidays, to render repair service or furnish equipment and supplies for such emergencies or special occasions as may arise. The first occasion for furnishing this emergency service occurred when a pipe welder ran out of welding rods about eight o'clock in the evening. He was working on a pipe header in a public-school heating system. A new supply of rods was made ready for delivery while the welder's truck was on the way to the storeroom, and the welder was back on the job with a loss of less than one hour of time. L. R. McKean, manager of the Harris Sales Co., states that this new service is a part of a general expansion program which will be extended over into 1931. He reports a good volume of business in November of last year and an increased volume of business in December, with indications that 1931 will be an unusually satisfactory year.

LINDE TO EXHIBIT AT MID-WESTERN POWER SHOW

The Linde Air Products Co., 30 East 42nd St., New York, N. Y., will occupy booths 315 and 316 at the Mid-Western Engineering and Power Exposition, Chicago, Ill., February 10 to 14. The Linde exhibit will feature the strength and dependability of oxy-acetylene-welded joints for power piping and equipment.

Typical specimens of welded piping construction will be displayed, together with the newest types of welding apparatus and accessories, including the following: The Linde Liner, which insures better welds in heavy-duty piping; the Oxweld portable tensile-testing machine, which will be operated in the booth to demonstrate how easily welds can be tested in the field; the Oxweld Type W-17 welding blowpipe, with the CW-17 cutting attachment which converts it into a cutting blowpipe, and the W-17 to W-15 adaptor which makes it available for light-sheet-metal welding; the Oxweld Type R-43 oxygen welding regulator; and a new machine for making ductility tests in welds.

A large illuminated map showing the nation-wide distribution facilities of this and asosciated companies will also be featured. H. H. Griffith will be the representative in attendance.

ALL E-M SYNCHRONOUS MOTORS NOW OF ARC-WELDED CONSTRUCTION

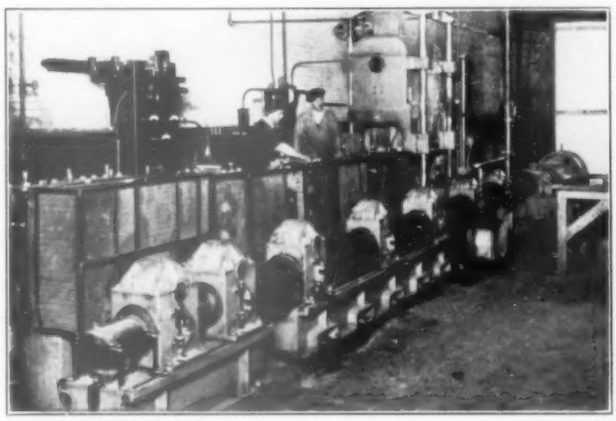
The Electric Machinery Manufacturing Co., of Minneapolis, Minn., announces that an arc-welded fabricated steel frame construction will now be used for the stators of all E-M synchronous motors of both medium and slow speed. This follows a recent change from a two-piece cast-iron stator to a welded steel stator for small-size motors, and completes the changeover to fabricated steel stator frames. This change makes uniform in appearance and general construction the entire line of E-M engine-type and coupled-pedestal-type synchronous motors.

The box-type stator construction, which is used for the entire line of E-M slow-speed synchronous motors, gives the following advantages: increased strength and rigidity, decreased weight, increased ventilation, more pleasing appearance, and uniformity of construction.

WELDING HIGH-CARBON STEEL TUBING

A new process for electrically welding high-carbon structural steel tubing is announced by Steel & Tubes, Inc., Cleveland, a subsidiary of the Republic Steel Corp. The new equipment is located at the Elyria, Ohio, plant and it is an adaptation of the patented Johnston process of electric welding owned and developed by Steel & Tubes, Inc.

The new style of electrically welded high-carbon tubing differs from ordinary steel tubing in its much greater strength



Machine for Arc Welding High-Carbon Tubing.

and rigidity. The process is the result of over two year's experimental work by company engineers. In the old style of forming, the tubing was rolled into an open seam or butted tube. In the brazed form, the seams were united by spelter consisting of a combination of soft metal. The new electric-welding process forms a union of the metal itself at the seam, making the tube much stronger than brazed tubing.

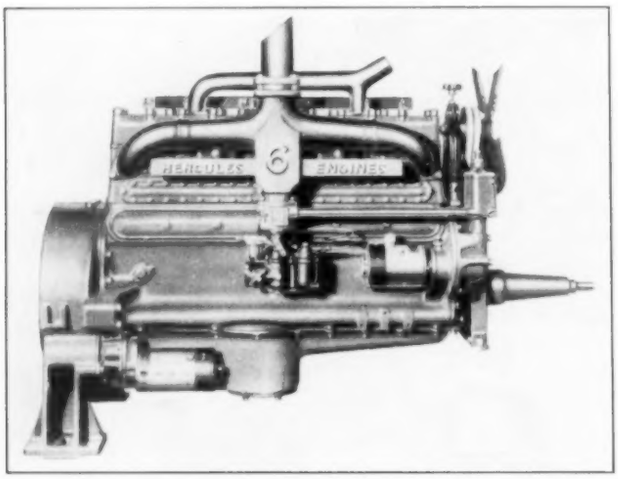
The tube is homogeneous and has a smooth finish with the welding seam rolled down so as to become almost imperceptible. According to company engineers, tests have shown that it will withstand severe mechanical bending and forming operations. It can also be hot galvanized, which was not commercially possible with brazed tubing.

Steel & Tubes has been a large maker of high-carbon butted and brazed structural steel tubing for the last 25 years. The new tubing is said to be in demand by manufacturers of farm implements, dairy equipment, bedsteads, scaffolding, shores, towers, wheelbarrows, playground equipment, fence posts, and similar products. The equipment, which has just been placed in operation, manufactures the tubing in several gages and intermediate sizes ranging from ⅞ to 2⅜ in. outside diameter, in round, square and rectangular shapes.

HERCULES MOTORS ADD TO THEIR LINE OF HEAVY-DUTY ENGINES

A larger series of heavy-duty six-cylinder engines is being offered by the Hercules Motors Corp., of Canton, Ohio. This series, known as the "HX," is produced in five different sizes, the largest having a displacement of 935 cu. in. and the smallest a displacement of 638 cu. in. These engines are capable of operating at greater speeds than heretofore recommended or thought logical for engines of like displacement, says the manufacturer. The cast crankcase is supplied in either aluminum or grey iron, and is secured to the cylinders by means of 16 through-bolts. Like other six-cylinder Hercules motors, these have the crankshaft supported on seven main bearings, having a total projected area of 58 3/16 sq. in.

A feature of these new engines is that the connecting-rod bolts, which secure the "caps" to the rod, are forged integrally with the rod, thus putting the clamping action much



The Crankcase of This Heavy-Duty Engine Is Secured to the Cylinders by Means of 16 Through-Bolts.

closer to the bearing edge than is the case where the rods are drilled and separate bolts are used. This design also assures extreme strength, since the rod is not weakened by the usual drilling for the bolt and head.

The cylinders are cast in pairs of three, with removable heads so designed as to accommodate two sets of spark plugs where double ignition is desired.

A feature making the HX engines particularly desirable for portable outfits is the full-pressure-type, gear-driven oil pump of great capacity, with a double-scavenging pump arrangement which assures proper circulation of the lubricant carried in the oil pan, even though the engine may be operating at a marked degree from horizontal.

Other equipment includes an air cleaner and oil purifier of ample capacity, a fuel-pump drive, and an auxiliary V-belt drive for large-size generators. The water pump delivers 135 gallons per minute at 2,000 r.p.m. The cooling fan has six blades and is driven by double V-belts. Special attention has been given to proper cooling of the valves. Manifolds can be supplied in either the downdraft or improved updraft type.

The suspension of these engines is available in either the three- or four-point type, with a choice of bellhousings. Either a sleeve or base type of generator is provided for. It is also possible to drive an air compressor from the crankshaft, or it can be installed as a side-mounted unit. The developed torque ranges from 410 ft.-lb. for the smallest engine to 610 ft.-lb. for the largest, this maximum torque being being practically constant at from 800 to 1,200 r.p.m.

These engines are being displayed at the A. R. B. A. Road Show, which is being held in St. Louis, Mo., from January 10th to 16th.

UNIVERSAL HIGH-VOLTAGE TESTING SET

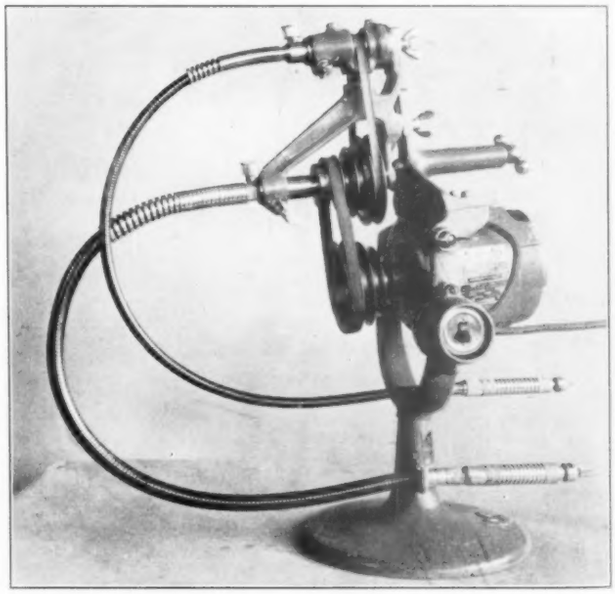
A highly accurate testing set of unusually flexible design is found in the AmerTran Type TS-15A, which has just been announced by the American Transformer Co., 179 Emmet St., Newark, N. J. This apparatus is ideally suited for light testing in either the factory or laboratory where potentials from 500 to 20,000 volts at 1 kva. are required. It is being used successfully in making accurate dielectric-strength measurements on materials such as paper, tape, compound, varnished cambric, condensers, and insulation in small apparatus. It operates from 110-volt, 60-cycle circuits and permits obtaining 5,000, 10,000 and 20,000 volts. The equipment includes a wire-wound potentiometer for adjusting the voltage. For protection against damage due to overload a quick-acting circuit breaker is provided.

NEW MACHINE HAS TWO FLEXIBLE SHAFTS FOR HIGH AND LOW SPEEDS

A new double-flexible-shaft machine, first shown at the recent Power Show held in New York, has been developed by The Keller Mechanical Corp., 72 Front St., Brooklyn, N. Y.

The first shaft is for ordinary work requiring the use of tools with 1/16 to ¼-in. shanks running at four speeds, ranging from 875 to 3500 r.p.m. The second shaft, which is the upper and lighter shaft, is for high-speed work, with a speed range of from 5,250 to 10,500 r. p. m., and is ideally suited for delicate work with small burs and grinding stones, such as those used for finishing and polishing dies.

The light-shaft assembly may be attached to any Kellerflex machine with four-speed pulleys, thereby doubling its



New Double-Shaft Kellerflex Machine.

usefulness. This requires simply changing the overarm for one that carries a small pulley mounted on ball bearings. A V-belt, running in the largest jack-shaft pulley, is provided.

Since the work to be performed by the high-speed shaft is of a delicate nature, the shaft is made light and more flexible. To release the strain on the shaft, slots are milled on the motor bracket so the whole unit may be moved until the balance point is found. This permits easy swiveling and places no strain on the shaft, as the machine is balanced in all positions.

To accommodate the shaft and small grinding stones, a small patented hand piece has been designed, which is of lighter construction, but is strong and rigid, with no play

in the spindle, due to self-adjusting ball bearings. The outside diameter being only ¾ in., the tool may be held in the fingers for very fine work. Felt washers protect the ball bearings, and allow no grit to get in or any of the oil to run out. The small shaft may also be used on the slow-speed jack shaft pulley.

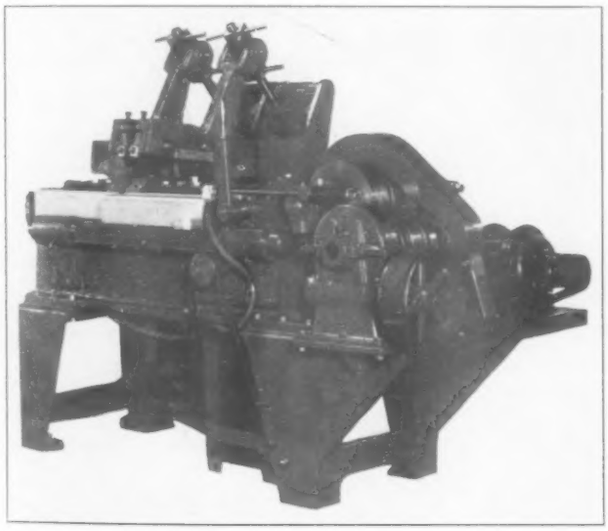
The larger shaft may be left on the machine for coarser work, so the workman may change from one to the other with no loss of time.

Another innovation is a 10-ft. shaft and sheath ½ in. in diameter, so designed as to run without chattering or vibration, thereby eliminating any loss of power in driving the tools. Here again is employed the new handpiece; and by means of interchangeable spring collets, burs or grinding stones may be used with shaft diameters varying from 1/16 to 3/16 in.

UNIVERSAL POWER-DRIVEN BUTT WELDER

A new power-driven butt welder, equipped with universal-type, air-operated, open-end clamps, making it practically a universal machine, suitable for the butt welding of certain classes of rims or for the welding of comparatively wide thin sections of strip stock or condensed sections within the capacity of the machine, has been added to the line of resistance-welding machines manufactured by the Thomson-Gibb Electric Welding Co., of Lynn, Mass., and Bay City, Mich., and is shown in the illustration.

The machine is equipped with a 200-kva. water-cooled transformer, thoroughly protected from all flash. The clamps are air-operated, operating through adjustable toggle links,



New Butt Welder for a Wide Range of Work.

permitting wide adjustment of jaw opening to take care of a great variety of shapes of work. The clamp bracket, clamp arms, etc. are made of cast steel. All pins are bushed with bronze bushings. Dies and jaws will take stock up to 7 in. in width, and the jaws are so mounted that they may be very quickly removed and replaced when necessary. The dies are water cooled and are made of hard-rolled copper and may be made in various shapes to conform to the work.

The power drive unit consists of a 2-hp. motor connected by a belt to a gear reduction unit which in turn operates the clutch shaft, geared to the shaft carrying the main pushup pressure cam. This pressure cam is of large diameter and unusually wide face, thus insuring long life. The power drive unit is normally gaited at 10 to 15 r.p.m., depending on the class of work to be welded.

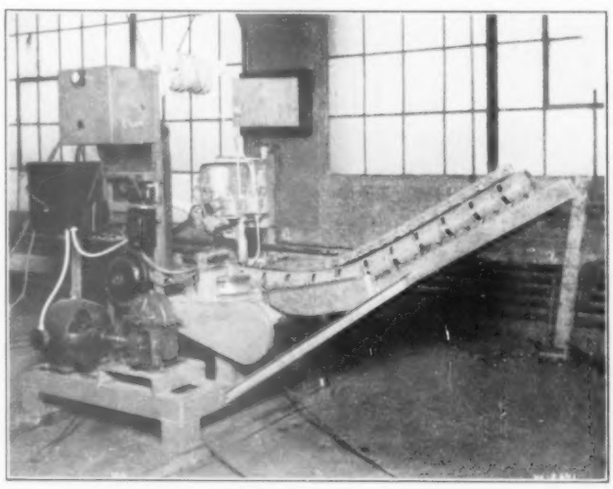
The valve for operating the clamps is controlled by a foot treadle, so arranged that both clamps operate in unison. After the work is inserted in the dies, the foot valve lever is depressed, closing both clamps. The clutch lever is then tripped by hand, the machine goes through its welding cycle, the clamps automatically open, and the platen returns to the open or loading position.

The stock capacity of the machine is up to approximately 2 sq. in., depending on the nature of the work and the cycle of operation. Special clamps and platens can be applied for special work.

AUTOMATIC WELDER FOR FRAMES OF AUTOMOBILE STARTERS

The Lincoln Electric Co., of Cleveland, Ohio, announces a new automatic welder for the welding of automobile-starter frames. This equipment embodies the principles of the shielded arc and utilizes the Electronic Tornado process.

The starter and generator frame are usually of 5/16 or ⅜



This Machine Welds 240 Starter Frames Per Hour.

in. plate, which is cut to size and shape, and punched and rolled into cylinders before being arc welded. The cylinders are then fed into a gravity conveyor, being guided automatically so as to keep the seams on top. At the bottom of the gravity conveyor, they go between two rolls, which squeeze the seams together tightly as they pass under the arc. No filler rod is used, the two edges of the seam being fused together.

The machine has a capacity of approximately 240 frames per hour, and one man and a helper can operate four machines simultaneously, giving an extremely low cost per frame. With the average cost of labor and material, frames can be welded for approximately one-half cent each.

The shielded arc utilized in this machine is said to give a weld of high tensile strength and remarkable ductility, with a pleasing appearance or finish.

FORMING ANGLES AND BENDS IN PLATES

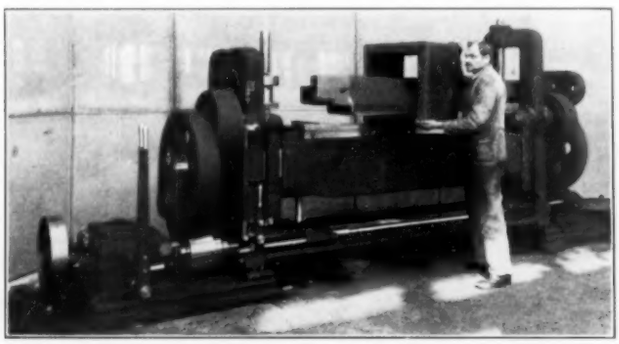
For bending sheet metal and plate, a machine known as the Schatz Universal Brake, Rounding and Box-Forming Machine has been developed by the Schatz Manufacturing Co., Poughkeepsie, N. Y. This machine is made for hand or power drive in widths from 40 in. to 20 ft. and for plate thicknesses from the thinnest to 1⅛ in. thick. It can be had with or without a swing-out top clamping bar, this adjunct being preferable for making closed forms, trays, boxes, tanks, etc., from one sheet of material.

Aside from the swing-out top-bar feature, other important characteristics include high adjustment of the top clamping bar, which on the largest power machine goes to 28½ in., and

the lowering of the bottom clamping bar and folding bar (apron) as much as 11¾ in. The high upward adjustment of the top bar permits the use of high angle-forming blades therein, having a usable height of at least 80% of the top-bar adjustment, for the forming of narrow channels or trays with high walls, besides the accommodation of bulky work between the bars.

The lowering of the bottom clamping bar and folding bar is resorted to when bends with a radius are made. The maximum radius that can be bent is equivalent to the maximum downward adjustment of the lower bars. These adjustments are made according to conveniently located graduated scales. The wide opening between the bars permits the introduction of round or rectangular mandrels, the former for tube forming or rounding and the latter for making smaller closed forms than can be made over the larger standard top bar.

By means of a patented system of attaching, the blades in the top bar are instantaneously interchanged without the use of screws or bolts of any kind. The blade in the folding bar



Power-Driven Forming Machine with Swing-Out Top Bar.

is slotted for quick change and is reversible for folding or bending thick and thin plates.

Boxes having wide or narrow inside or outside flanges can be formed up from one sheet of metal, which is a very important advantage on many other classes of work.

These machines are constructed like machine tools, sufficiently stable to guarantee highly accurate bends at the maximum capacities. They are available in either motor-operated or hand-operated types.

NEW AUTOMATIC AND STAINLESS STEEL ELECTRODES ADDED TO SWEDOX LINE

The Central Steel & Wire Co., Chicago, manufacturers of the Swedox line of gas and electric wires, recently announced two new electrode materials. One of these is the "Speedox" High Speed Welding Wire for both automatic and manual arc welding. This wire is produced by a special method which prevents the coating from flaking off or clogging the feed nozzle when the wire is being used on automatic arc-welding machines. Two different types of coating are used, one type being furnished when the wire is to be used for automatic arc welding, or hand welding, in flat position; the other coating when the work is to be hand welded in vertical and overhead positions. This wire is offered as an exceptionally fast electrode for production welding. It is now in stock in all the standard analyses for various steel-welding requirements.

The other new electrode is a stainless steel wire for welding the 18-8 alloys. It is claimed that this wire gives a fast desposit and lays down an unusually smooth bead. The nature of the coating is such that the slag accumulates at the center rather than at the sides, so that when the weld is ground down there are no valleys along the edges of the weld. Tests made with this stainless-steel electrode on parent metal having a specification strength of 95,000 lb. per sq. in. have shown a yield point of 83,000 lb., ultimate strength of 93,000 lb., and a 19% elongation in two inches. The test samples were nicked by grinding in at the sides so as to make sure of breaking them through the weld.

NEW LINE OF PORTABLE WELDERS

A line of special portable welding units, particularly adaptable for road service in localities beyond the reach of electric power lines, has been announced by the Westinghouse Electric & Manufacturing Co. These units are equipped with pneumatic-tired wheels and an oversize exciter for auxiliary power purposes, and are available in ratings of 200, 300, 400 amperes and larger.

One of the 300-ampere machines of this type was illustrated and described in the December issue of *The Welding Engineer*.

The 200-ampere unit consists of a standard Westinghouse single-operator generator, together with a 1½ kw., 125-volt exciter, driven by a four-cylinder gasoline engine. The welding generator is of the single-bearing construction, with the frame fitted directly into the engine flywheel housing, thus eliminating one bearing and simplifying shaft alignment. Drip proof construction is provided by the necessary enclosures.

The generator is separately excited from the 1½-kw. exciter overhung from the rear bracket. Full-load excitation requires only ½ kw., leaving 1 kw., 125 volts available for auxiliary power such as is needed for lights, grinders, buffers, drills, etc. The engine on the 200-ampere unit develops 24 brake hp. at 1,450 r.p.m., welding-generator speed.

BOOKLET SHOWS HOW WELDS ARE TESTED

"Fusion Welding" is the title of an illustrated booklet recently issued by the Babcock & Wilcox Co., of New York City. This company has plants in Bayonne, N. J., and Barberton, Ohio, which are nationally known for their accomplishments in the welding of large equipment. The booklet is prepared for the purpose of showing how carefully the welding procedure adopted by the Babcock & Wilcox Co. is tested and checked. It contains illustrated descriptions of tensile tests, elongation tests, bend tests, miscellaneous ductility tests, and impact tests. It shows how B & W weld metal is studied by means of the microscope, by fatigue-testing machines, by X-ray machines and by electromagnetic testing devices. Altogether the booklet is a convincing document as to the dependability of welds made by the B & W technique.

WELDING SCHOOL ISSUES BOOKLET

"Welding—What It Means to You" is the title of a 28-page booklet with cover prepared by the American School of Welding, Inc., 3031 Locust Blvd., St. Louis, Mo., for distribution to prospective students. This booklet covers quite broadly the general field of fusion welding and gives the reader an insight into the many and varied applications of the process. Many illustrations are used, including a picture of the school and several views of students in training, using both the electric arc and gas processes. Students are shown welding aircraft fuselages, large-diameter pipe, and structural shapes. Messages from W. D. Patterson, president of the school, and J. E. Patterson, director, are included. One page is devoted to questions about the school that are often asked, together with their answers.

NEW HOUSE ORGAN FEATURES WIRE

"Wire Engineering—A Distinctive Roebling Service" is the title of a new publication by the John A. Roebling's Sons Co., Trenton, N. J., which is to be issued periodically. This house organ covers engineering, technical, and news articles on wire rope, welding wire, flat wire, copper and insulated

wires and cables, etc., and in the first numbers a little of the history of the Roebling manufacturing processes is covered. This publication is of general interest to all users of wire, and the Roebling company anticipates an increasing field of usefulness for such information as it contains. The first issue features the use of Roebling Welding Wire in the welding of the new Edison Building in Boston, Mass.

CATALOG ON SOLDERING MATERIALS

A catalog issued by the Metal Bond Manufacturing Co., 4211 N. Broadway, St. Louis, Mo., describes such "Metal Bond" products as tinning compound, hard solder, aluminum solder, special body solder, brazing and welding fluxes, "Mouldough" for backing up metals to weld against, soldering irons, and "Seal-X-O" for making arc welds water-tight and as a filler for rough welds. Complete directions are included for tinning and soldering. Goggles, helmets, lighters, electrode holders, and other equipment are also listed.

DESCRIBES TECHNIQUE OF ALUMINUM WELDING

"The Welding of Aluminum" is the title of a booklet being distributed to the trade by the Aluminum Company of America, Oliver Building, Pittsburgh, Pa. Information is given on the use of the oxy-acetylene and oxy-hydrogen welding flame, adjustment of the torch, size of tip to be used and gas pressure required for aluminum of different thicknesses, pointers on flux, and data on the tensile strengths of welded and unwelded tubing. The instructions given are clear and easily followed.

NEWS OF THE WELDING TRADE

Announcement has been received that the Southwark Foundry & Machine Co. transferred the major portion of its assets to the Baldwin-Southwark Corp. of Philadelphia, Pa., as of December 31, 1930. The latter corporation has assumed all outstanding liabilities and will carry on the entire business formerly done in the name of the Southwark Foundry & Machine Co.

On January 5th, the American Chain Co., Inc., moved their Boston offices, which were formerly located at 132 High St., to Room 1214 in the Statler Building, Boston.

Reports received from the A. O. Smith Corporation of Milwaukee indicate that during 1930 it shipped 472,000 tons of electrically welded pipe to all parts of the United States, compared with 425,000 tons in 1929. The plant has a daily capacity of more than thirty miles of pipe.

The amalgamation of the Alloy Welding Processes, Ltd., and The Premier Electric Welding Co., Ltd., both of London, England, has been announced. The new company, which has been operating as from January 1st, is known as Murex Welding Processes, Ltd., with address at Ferry Lane Works, Forest Road, Walthamstow, London, E. 17.

The Victor Welding Equipment Co., of San Francisco, Calif., opened its own factory branch store at 2032 Santa Fe Ave., Los Angeles, Calif., on November 1, 1930. This branch store is under the direct management of J. C. Blake, who is well known in southern California and was formerly general sales manager of the Stoody Company. Mr. Blake will have three men to assist him in the southern California territory, and the store will maintain a completely equipped factory repair department as well as full stocks of Victor welding and cutting equipment.

One of the first welded steel boats built on the Pacific Coast is under construction at Long View, Wash., in the machine shop operated by W. C. Cheney. The boat is 42 ft. in length and will be used as a tug by the owner, Wm. J. Smith, of the Ranier Towing Co. Work has progressed to the point that the main body has been finished, forward and aft compartments have been fitted, and the deck has been constructed, all without the use of a single bolt in the construction.

The Steel Tank & Pipe Co., Portland, Ore., manufacturers of West Coast boilers, is now reported to be operating with a full crew. It has closed a good year's business with the production of steel houses for gas and oil stations and welded pipe.

The Flywheel Welding Shop, of Portland, Ore., recently moved into new headquarters at 35 Union Ave. This shop makes a specialty of welding automobile-starter teeth.

A test of the new welding fuel known as "hellam gas" was recently made at the Commercial Welding Co.'s plant, Seattle, Wash., in the presence of state and city fire and boiler officials. The test was conducted by the Seattle Oxygen Co. It is reported that the results of the test were satisfactory.

The Aeroil Burner Co., West New York, N. J., manufacturers of oil-burning preheating torches, announces the appointment of Herbert M. Orschel as field sales manager. Mr. Orschel will travel extensively throughout the United States and Canada for the purpose of increasing the general scope of the company's activities.

The December meeting of the Los Angeles section of the American Welding Society, held Thursday evening, December 18th, consisted of a visit to the machine shops of the Southern Pacific Railway Co. in Los Angeles. O. B. Schwendy arranged for the visit on behalf of the Southern Pacific, and Frank Longo, welding supervisor for the Southern Pacific Co. shops, acted as official guide through the shops. It was a very interesting visit, and many and varied applications of welding in railroad-shop work were seen.

W. O. Burrows, formerly with the Standard Oil Co., and stationed at Santa Fe Springs, Calif., recently opened a private welding shop at Slauson and Wilmington Aves., in Huntington Park, Calif. Mr. Burrows will specialize on hard facing work in addition to general welding of all kinds. His shop is equipped with both gas and electric equipment.

A new welding shop is being opened at 6355 S. Compton Ave., Los Angeles, Calif., under the management of Guy Peerson, and to be known as the Standard Tool & Supply Co. Mr. Peerson will feature general welding work of all kinds. His shop is being equipped with up-to-date conveniences and includes both electric and acetylene welding equipment. This location was formerly occupied by the Progressive Welding Works.

Lee Woods, welding-shop owner, who recently operated a shop on East Ninth St., Los Angeles, Calif., has moved to a new location at 1669 S. Alameda Ave., the move being necessitated by plans of the city to build a viaduct near his old location. Mr. Woods features general welding work of all kinds, together with blacksmithing, and specializes on truck building and repairing.

A. S. Waggoner, who until recently was in charge of the Venice, Calif., branch welding shop belonging to Fay Lindbery, has been transferred as manager of the Lost Hills branch. C. H. Camper, formerly in charge of the Lost Hills shop, replaces Mr. Waggoner at Venice.

The Vanberg Engineering Co., of 831 S. Crocker St., Los Angeles, Calif., is being reorganized by its new owners and

managers, H. W. Vanberg and J. (Jack) C. Hunter, who recently purchased the interest of Eugene Clem, a former partner. The new company will feature general welding work of all kinds—both gas and electric—and will also maintain a well equipped machine shop in connection with the welding department. Mr. Vanberg and Mr. Hunter are both well known in and around Los Angeles, having been associated with the welding industry in that vicinity for the past eight years.

The Huntington Park, Calif., high school is offering a night course to those wishing to learn welding. A class was recently organized, and is under the supervision and instruction of O. A. Lund, welding inspector for the Los Angeles Gas Co. Mr. Lund has had 17 years of welding experience, and has had charge of the instruction in the welding classes of the Huntington Park school for five years. A good enrollment is expected.

An evening course in welding is being offered under the auspices of the high schools of Glendale and Pasadena, Calif. Classes were recently organized in each city under the instruction of V. P. Dixon, who is associated with the Los Angeles Gas. Co. in their welding department. Mr. Dixon, who has had a number of years' experience in welding, is handling the instruction of these classes on a night-about plan, going from one school to the other every other night. A goodly number are in attendance in each class.

The Standard Machine and Auto Works, of Pasadena, Calif., who do general welding in connection with their auto body and machine work, report the recent purchase of a new Lincoln gas-engine-driven welder. A marked improvement in time saved and higher quality of work over old methods is noticed by this concern since the installation of the new machine. This is the first electric welder for the shop.

The Taylor-Winfield Corp., Warren, Ohio, reports orders during the month of December for over 160 spot and butt welders. These were all automatic machines and were of all sizes and types.

R. L. Cronemeyer, formerly connected with the Westinghouse Electric & Mfg. Co., recently joined the organization of the Big Three Welding & Equipment Co. at Tulsa, Okla., where he will specialize in the sale of Lincoln motors, which are carried by the Tulsa office of the Big Three Welding & Equipment Co.

It is reported that the name of the Houston Iron Works, of Houston, Texas, has been changed to the Humble Welding & Specialty Works. This company does a considerable business in the manufacture of equipment for oil-field operations.

The Institution of Welding Engineers, at the meeting held in London, England, on January 8th, gave consideration to "The Use of Pure Iron Electrodes for Welding Cast Iron," which was the title of a paper read before the members, the authors being H. D. Lloyd and J. S. G. Primrose. The lecture was illustrated with lantern slides, and a general discussion followed.

The Pan-California Oil Corp., of Long Beach, Calif., is erecting a new 12,000-gallon natural-gasoline plant in the Venice oil field. Welded installation of equipment and pipe connections are by oxy-acetylene. The practical use of welding in this plant is emphasized by the installation of the charging lines, which are all welded with graduated turns.

It is reported that arrangements have been made for a merger between The British Oxygen Co. of England and the Allen Liversidge organization. This will bring together two of the most important gas-producing firms in the British Isles, one of which has been engaged in the oxygen production business and the other in the production of acetylene.

The 1931 calendar which is being distributed by the John A. Roebling's Sons Co., carries a beautiful picture of the Hudson River bridge now under construction. It is accompanied by a little folder which gives some interesting data concerning this huge bridge, including the information that the weight of the main cables totals 57,000,000 lb.

The Robert W. Hunt Co. have for distribution a reprint of the paper on "Inspection of Welded Steel Buildings" which was read by Franz Eder of their organization before the 1930 annual convention of the International Acetylene Association.

A new welding shop is being opened for business in the Venice, Calif., oil field, to be known as the H & H Welding Co. The new shop will be operated under the management of three partners: J. H. Hodgen, J. H. Hood, and O. F. Harding. Special attention will be given to the servicing of oil-well digging bits and pipe-line construction, as well as welding jobs of all kinds. The partnership also operates a welding shop in Long Beach.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
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Count 8 words to line. Add 6 words for keyed address.

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Welder Wanted—Experienced in electric and acetylene welding, for large job welding shop. Married man and one who knows radiator work preferred. State age, experience, and salary expected in first letter. No welding school student need apply. Address Mendota Welding and Supply Co., Mendota, Ill.

Expert Welder With Sales Experience Wanted in the Chicago territory, to take charge of sales of welding wires for leading Chicago iron and steel manufacturer. Address Box 300, The Welding Engineer.

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Pacific Coast Distributor Wanted—For complete line of gas and electric welding wire. Must be live wire organization and doing business with large users of welding. Address Box 301, The Welding Engineer.

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Salesman—Twelve years' experience as a welder, electric and acetylene, oil field, pipe line, and shop. Will go any place as welder or salesman. Address Box 297, The Welding Engineer.

Welder-Mechanic—Wants job on power plant, refinery, pipe line, or tank work. Ten years' experience, gas and arc. Good mechanic. Address G. Hutchings, 135 Putnam Ave., Cambridge, Mass.

(*Continued on page* 63)

Cracks chamfered out and ready for filling in with Tobin Bronze.

Close-up view of welds made with Tobin Bronze.

Fractures repair-welded with Tobin Bronze.

TOBIN BRONZE *welded this heavy machine* Without Preheating

A CAST-IRON machine used for pulverizing rubber was fractured in three places. To preheat the parts would have been difficult if not actually impossible. Consequently Tobin Bronze Welding was recommended by an experienced welder.

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Silicon Copper	1981°F
Phosphor Bronze	1922°F
Everdur*	1866°F

for arc welding

Silicon Copper	1931°F
Phosphor Bronze	1922°F
Everdur*	1866°F

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- American Institute of Mining and Metallurgical Engineers
- American Society of Mechanical Engineers
- American Society for Steel Treating
- American Welding Society
- American Society for Testing Materials
- Institute of Metals
- National Purchasing Agents Association
- Pacific Coast Electrical Association
- Pacific Coast Gas Association
- Society of Automotive Engineers

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Acetylene Welder—Wants job pipe-line welding or general shop welding. Three years' experience acetylene welding. Address Leonard Larson, Box 207, Judith Gap, Mont.

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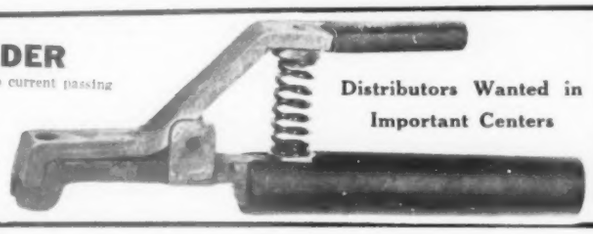
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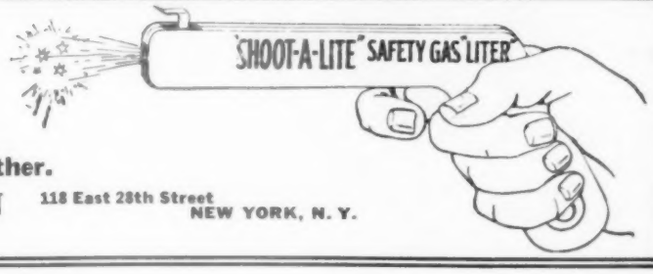

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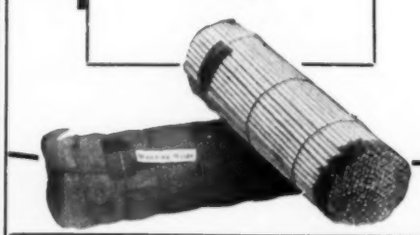

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